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THE COMMON NEWT.

By GRANT ALLEN.

IN the spring, according to the Poet Laureate, the wanton lapwing gets himself another crest. Just about the same time, the little water-newt, though unsung of bards, does precisely the same thing, and for precisely the same reason. There is hardly a clean pond or pool in England where one cannot find these pretty and common small creatures with a very little hunting; and yet I am often surprised to find how few people, comparatively, are at all on speaking terms even with *Triton punctatus*. At the present moment they are in their very best new spring finery; and it is well worth while looking for them, or their lordlier cousin, the great water-newt, before time has begun to dull the splendour of their first crimson and orange wedding-suit. All you have got to do is to stand on the edge of the pond, and peer down for a moment, where the water is clear, on to the soft, muddy bottom. There you will see lurking on the grey ooze, or floating half-way up among the waving tresses of water milfoil or crowfoot, a small, brown, lizard-like form, ill-defined against the similarly-coloured background, but discernible after a minute as a darker patch of shade upon the pale clay of the bottom. Put your hand down cautiously into the pond, approaching him, if possible, from in front (for he darts away forward, and is a bad hand at turning sharply), and you will probably find him the easiest water animal to catch and hold in all England.

When you have got him out and can examine him at your leisure, you will observe that he has a long crest down his back and along his lizard-like tail; and if he is just in his full prime, the jagged tips of the crest will be tinted with crimson, to make him still more attractive to his fastidious mates. In the autumn, these crests disappear altogether, being absorbed into the body of the animal; for then food is scarce, and no useful material can be wasted on mere external decorative adjuncts. But when the spring and the breeding season come round again, and when worms, and pond snails, and water insects are once more plentiful, the little newt begins to wax fat and kick, and to array himself in his wedding garment. His crest grows anew along his back and tail, and at the highest point of vigour it assumes its crimson tags, so that he becomes for a while a very handsome and ornamental little amphibian indeed. If you turn him over on his back (a position which he doesn't much relish, and from which he manages to wriggle right side up again with marvellous rapidity) you will see that his under side is suffused with a very bright orange hue, which, when the crest is crimson, assumes a tone of the most vivid brilliancy.

Of course, these beautiful colours and decorative appendages have been acquired by the male newts through the long-exerted selection of the handsomest among their ancestors by the females of their kind during an innumerable series of earlier generations. This is very well shown by several converging lines of evidence. In the first place, the males are much less frequent than the females, and Mr. Darwin has pointed out that decorative devices of this sort most frequently occur among polygamous species; because there each male has to acquire and preserve for himself a considerable harem, which he can only do by the combined attractions of superior strength and beauty. Then, again, the crest and colours are peculiar to the males, and do not occur, or only occur to a much less marked extent, among their mates. Once more, these decorative devices appear in the breeding season, culminate with the period of spawning, and disappear again upon the approach of autumn. I do not know whether battles have ever been observed between the male newts, as usually happens with decorated animals; but the great crested newt, at least, I am sure is a very pugnacious creature, and his characteristic attitude of craning his head and showing fight when taken out of the water has evidently given rise to the common belief of boys and country folk that "newts spit fire."

The female newt lays her eggs usually on a folded leaf of some water-plant, which she gums together into a sort of pouch by means of a sticky secretion. Sometimes, however, she hides them in the angle between a leaf-stalk and the stem, where they are almost equally safe from the attacks of their enemies. The tadpoles, when first hatched, may be looked upon as almost the nearest approach of any existing vertebrate animals to the common ancestor of the whole vertebrate race. They are tiny, helpless things, with long, thin, flat tails, external gills like much-divided leaves, and a pair of wee claspers by which they hang on to the stems of water-plants. As the tadpole grows, however, the claspers are gradually absorbed, and the fore-limbs, which at first were mere rudimentary fins, lengthen out into legs with minute knobby toes at their extremities. By-and-bye, the hind feet and legs also make their appearance, and the tadpole is now quite lizard-like in shape. Still, like all the amphibians in their early stages, the young newt is even so essentially a fish in the most important points of structure. But as soon as the tadpole has reached its full development a wonderful piece of evolution enacts (or rather recapitulates) itself before our very eyes. The external gills grow smaller and smaller, till at last they disappear altogether. Then the clefts in the neck by which is expelled the water taken in at the mouth grow covered with skin; and, finally, the newt turns from a water-breathing, fish-like tadpole, to an air-breathing adult amphibian. For the most part, the full-grown newts stick to their native pools, only coming up now and again at considerable intervals for a fresh pull of air: for being sluggish and cold-blooded creatures, they don't need any large amount of oxygen to carry on their tardy bodily movements and functions. But a fair number quit the water altogether, and creep over damp grass, or even stray into neighbouring cellars. I am sorry to say that when found in the latter situation, a horrid superstition, still rampant among housewives, condemns them to be

thrown into the back of the kitchen fire. Like their allies, the south European salamanders, they have a bad reputation, wholly undeserved; they are accused of being poisonous, of being unlucky, and most extraordinary of all, of being incombustible. As a matter of fact, they are absolutely harmless little creatures, and they help to keep the cellar clear of slugs, grubs, and small insects.

The tailed amphibians, such as the newts, are among the most interesting links in the whole of existing nature, as they lead us on in so unbroken a chain from the ganoid fishes to the frogs and true lizards. The West African Lepidosiren, a fish with rude legs (to put the matter plainly), and provided with both gills and lungs, comes very close to the Proteus, that strange, underground amphibian of the Carinthian caves, a newt, so to speak, which never passes beyond the tadpole condition, but retains both gills and gill-slits throughout its whole life. Above the Proteus, again, we get such other intermediates as the Amphiuma of the Carolinas, which lose the external gills in the adult state, but still retain the gill-slits, thus going through what may be called an imperfect metamorphosis. Then, once more, we have creatures like the Mexican axolotl, which does not usually undergo any metamorphosis at all, but which, under exceptional circumstances, gets rid of its external gills, and turns into something very much like a common salamander. Finally, we get our English newts, which can wander about on dry land if so they will; and, still more advanced, the black salamander of the Alps, which never goes near the water at all, and in which accordingly the tadpoles undergo their metamorphosis within the body of the mother. These perfectly terrestrial amphibians (excuse the obvious bull, for which scientific nomenclature rather than the present perpetrator is responsible) really differ from the lizards only in anatomical points, and though they cannot be regarded as in the strict sense a connecting link between the two groups, they at least serve to show us by analogy the steps whereby lizards may have developed from a common fish-like amphibian ancestor. Thus our little pond-newt helps us to reconstruct mentally the line of descent whereby man and all the other higher mammals have ultimately been derived from a primitive lung-bearing ganoid like the Lepidosiren.

HOW TO GET STRONG.

MUSCLES OF THE UPPER THIGH.

(*Continued from p.* 279.)

WE have already noted that jumping is an excellent exercise for the upper thigh muscles; and that it is far better to practice easy jumping for some time than to try for a short time how high one can jump. The Hon. Geo. Lawless's practice (see "Frank Fairlegh"), however unsatisfactory as a cure for a wounded heart, may be confidently recommended as a remedy for weak thighs. Put a light stick across from one chair-seat to another, placing it so that it will fall if not cleared, and then if your room is large enough run lightly round and jump over the stick, continuing your circuits till you begin to feel tired and out of breath. Mr. Lawless, if I remember rightly, placed the stick across the tops of the chair-backs, and ran backwards and forwards, instead of round and round. But then he was probably in better jumping condition than most of our readers, who would be content with his number of jumps (100) over the height of the chair-seat. Take the jumps as lightly and easily as possible. Try to do it so that any one in the room underneath would not know you were jumping at all; you will fail in that probably, but your efforts will not be unrewarded nevertheless.

Steady running, not too far but carried on daily, is excellent for the thighs. Hopping also is good,—and dancing might be recommended but for the difficulty of persuading any one, especially any young person, to attempt so distressing an exercise. Let them take courage, however, and they may find even dancing bearable in the good cause they have in hand. I could tell wonders of what some young folks have endured in this way. Walking up hill and skating are both good for the thigh muscles. Unfortunately it is impossible to get much skating in this country.

All such work as digging, shovelling, lifting, and so forth strengthens the upper thigh muscles. Some who have much work of this kind to do, get these muscles over-developed, and rather stiffened than properly strengthened. But probably few of those for whom we are writing are likely to injure themselves this way. We know dozens of weak-legged folk,—especially weak about the upper thigh—who could do themselves a world of good by digging for half an hour or so every day.

Fencing, with plenty of good lunging, is admirable for the thighs. It is astonishing how few are able to go through even the extension exercises properly. Note that both legs are exercised in passing from the second to the third position in fencing, or sword exercise generally. In the first position the weight of the body rests on the left leg, and the right, though advanced and touching the ground, should bear scarcely any of the weight. Standing in this position, the swordsman ought to be able to carry the right foot backwards by the balance-motion (not that this movement belongs to fencing) without in any way changing the bearing on the left foot. The balance-movement should be executed thus several times, the left leg and foot remaining simply at rest. Next the body should be lowered and raised steadily on the left foot, the balance-movement steadily continuing. Then the right leg and foot should be made to take their turn, the left foot being swayed steadily backwards and forwards in the balance-movement. After both right and left leg and foot have been well exercised in this way, the third position should be assumed, in which the right leg is thrown forward as in lunging, the greater part of the weight of the body resting well on it (the right leg from the knee down forms the short upright leg of a right-angled triangle, of which the longest side is formed by the left leg and the thigh part of the right leg). In this position the gradual alternate lowering and raising of the body, give splendid exercise to the right thigh and knee. The right leg from the knee downward, sways through a slight arc round the foot as a centre; the left foot remains still—unless it slips, as it is apt to do on a carpet or smooth floor. Repeat this exercise with the left knee forwards. The arms can be exercised conveniently in divers ways at the same time, or may be crossed behind the waist, the hands holding opposite elbows.

If instead of such exercises, which are a trifle dull, you prefer actual fencing and singlestick, which may be made exceedingly lively, you should be careful to use the left hand as well as the right. It is just as good fun and the exercise tends much more to symmetry when thus balanced.

Riding is also good exercise for the thighs. Blaikie recommends walking with short steps as more likely to render the thighs stout and strong than walking with good stride, which makes the step easier: but I cannot recommend the adoption of a short stumpy walk. Possibly as an American Mr. Blaikie thinks it desirable to be much on the stump. But what is worth being done at all is worth being done well, and stumpy walking is not good walking.

THE THIGH NEAR THE KNEE.

The sedentary man seldom has the muscles of the lower thigh, that is, of the part of the thigh near the knee, properly developed. Walking lazily does not call these muscles into action. But if any one who has been in the habit of walking with limber legs, and knees rather bent, will try the experiment of straightening the knees as he walks, he will soon find the muscles of the lower thigh telling him emphatically how weak and how easily tired they are.

One of the best exercises for these muscles is that of touching or trying to touch the ground with the fingers without bending the knees. This exercise should be pursued steadily for a short time every day. I have already referred to its value in limbering and strengthening the waist muscles both front and back. It is excellent for most of the back muscles of the legs, and it is convenient to be able on occasion to reach to the ground without bending the legs. A little steady practice every day will astonishingly increase this bending power.

Walking uphill is splendid work for these lower thigh muscles, and good in many ways besides. Going up stairs is good work too, and though it is not easy to go in steadily for this sort of exercise—because there are always people who want to use the stairs—one can often get a good deal of work this way in the regular day's work. Not every one knows how to go up stairs properly, by the way. A man's way of walking up stairs affords a good measure of his intelligence. The average servant, if you notice, goes up stairs as if kicking through the top of the step were the object to be specially aimed at. Children and boys up to fourteen or fifteen—girls, I am afraid, quite as long—adopt the same unreasoning stair-top-kicking gait. I would have the art of getting up stairs taught at school before drilling, and the average absurdity known as calisthenics. What can be more pleasing than the springy gait of an intelligent person on his or her way up stairs. The foot is not driven at or along the top of each stair, but rested on it lightly; the weight of the body then brings down the spring of the foot nicely until, when the other foot has taken its stair in the same easy plantigrade way, the spring recovers itself and lightly lifts the body on. I would as lieve for my own part see a man hauled up stairs like a sack as see (aye, and hear and feel) him shuffle and kick himself up in the average way of "getting up stairs." (*Such* a getting up stairs, indeed!) The reward of adopting this light, springy, clean-treading way of going up stairs is that you go up with less labour, yet with more useful exercise, especially for the muscles of the foot, ankle, knee, and lower thigh.

But my own constant practice for the last twenty years, and the practice I mean to follow till gravity begins to get the better of me, is to go up stairs (as well as down) two steps at a time, aiming at such a movement, by a slight relative lowering of the body at each rising of the feet, that the actual motion of the centre of gravity is as near as possible on an inclined straight line. Going up stairs this way is capital exercise, and is satisfactory to the intelligence as well as pleasing to the understanding.

(*To be continued.*)

THE UNIVERSE OF SUNS.

By RICHARD A. PROCTOR.

(*Continued from p.* 286.)

THE principle adopted by Sir W. Herschel in both the two last papers of the series which he contributed to the Royal Society is that the distances of stars and star-clusters may be inferred, taking one with another, from the amount of light we get from them. He recognised of course that taking two stars or two clusters of unequal apparent lustre the brighter might really be the farther; but he assumed that a great number of stars or clusters of about the same apparent lustre must have an average distance from us less than the average distance of another considerable number of stars or clusters, resembling each other in apparent lustre but less lustrous than the members of the former set or family. In the paper of 1817 he applied this principle to the stars, in the paper of 1818 he applied it to the nebulæ. Applied either to stars of to nebulæ, the principle is unsafe on *à priori* grounds; and under every test which has been applied to it, it has been found to fail.

Take first the argument from analogy.

If man's life were as the life of the day-fly, but his vision—natural or aided by instruments—were keen enough to show him all the members of the solar system, including the asteroids, moons, meteor streams, and so forth—he would suppose Venus, Jupiter, Mars, and Saturn to be the nearest, Mercury, Uranus, Neptune, a few of the chief asteroids, the moons of Jupiter, and the two largest moons of Saturn much farther away, most of the minor planets and the smaller Saturnian moons much farther away still, and the two moons of Mars at the very outskirts of the system—which he would regard as on the whole shaped like a flat disc. Meteor streams he would regard as probably much remoter parts of the system, or perhaps as outlying systems of the same nature, while comets would seem doubtful objects possibly made up of separate bodies but possibly consisting of some kind of luminous gas. He would form the same general views but there would be slight differences of detail, whether he estimated the distances of bodies by their lustre or by their apparent diameters.

These views would, we know, be entirely erroneous, and we can see that even if observations were not continued long enough to show the laws of planetary motion, the recognition of the arrangement of the various bodies, and in particular the gathering of moons in the neighbourhood of their primaries, and of cometic and meteoric systems in special directions, would show careful reasoners that the principle on which those views had been based was erroneous and misleading.

This analogy shows the unlikelihood that the principle adopted by Sir W. Herschel was true. The principle was practically proved to be untrue by his own observations, which had compelled him to recognise that the stars of the Milky Way are very differently strewn from those which lie in the immediate neighbourhood of the sun.* But the complete disproof of the principle belongs to later times, and to the observational work of Sir John Herschel (who, however, did not very strongly press the conclusions to which his work pointed), the computations of William Struve, the reasoning of Mr. Herbert Spencer, and to the combined processes of observation, computation, and reasoning which I have myself applied to the subject. This will be shown later on.

Assuming the principle, we need not, as Sir W. Herschel correctly pointed out, either suppose all the stars equidistant from each other, or that those of the same apparent

* The mere conclusions that they were differently arranged would not be inconsistent with the principle adopted by Sir W. Herschel, as the reasoning of the next paragraph shows; but Sir W. Herschel's careful explanation of the way in which their arrangement thus differs, and of their tendency to cluster within rounded regions, involves in fact the utter rejection of the principle, as certainly, though not so obviously, as Sir J. Herschel's later argument from the Magellanic clouds.

magnitude are equidistant from us. The principle justifies us however in assigning to each star a certain equal portion of space, and thence calculating how many stars a given region of space may contain. Obviously, reverting to the illustration derived above from the solar system, the very principle which had made the apparent smallness of the asteroids evidence of greater distance would lead to the conclusion that they are not arranged like the major planets, simply because within the limits of distance thus assigned to them there would not be room for so many asteroids as are visible, without much closer setting than the same principle would assign to the few larger planets.

Sir W. Herschel applied his principle to the stars of various magnitudes included in Bode's Catalogue of 14,414 stars. The result of the comparison was to show that if the order of magnitudes could indicate the distance of the stars, we should infer "at first a gradual and afterwards a very abrupt condensation of stars." But, says Sir W. Herschel, if we consider the principle on which these stars are classed, "their arrangement into magnitudes can only apply to certain relative distances, and show that, taking the stars of each class, one with another, those of the succeeding magnitudes are farther from us than the stars of the preceding order."

Which really amounts to this,—that if the results of applying the principle are interpreted on the assumption that the principle is sound, they lead to conclusions not inconsistent with the principle.

Sir William Herschel felt that this result was of no value. He therefore showed that to get at any useful result we must determine the true relative lustre of stars of different apparent brightness. "It will be admitted," he said, "that those stars whose light we can prove experimentally to be $\frac{1}{4}$, $\frac{1}{9}$, $\frac{1}{16}$ . . . . of the light of any certain star of the first magnitude must be 2, 3, 4 times as far from us as the standard star, provided the condition of the stars should come up to the supposed mean state of diameter and lustre of the standard star." He then showed how such comparisons might be made for the whole range from natural vision to the full extent of telescopic vision. In this part of his work we have again the William Herschel of 1789. By his reasoning here he established the general principle of space on which the estimate of the penetrating power of the telescope *for objects assumed to be of the same real size and brilliancy* depends.

Having now obtained a means, as he supposed, of estimating the relative distances of stars of different apparent lustre, Sir W. Herschel could examine the results of star-gauges made in different directions. He found that, thus dealt with, the stars of the tenth, eleventh, and twelfth orders of distance are not only more compressed than those in the neighbourhood of the sun, but moreover their compression in different parts of the heavens must be very unequal.

Let us grasp the meaning of this fully before we proceed. Sir W. Herschel here recognises that the number of the stars of the small magnitudes is such, that granting to them the average distance deduced from their apparent lustre they must be set more closely together than the stars of the large magnitudes. He also recognises that in certain directions they must be more closely aggregated than in others. It is as though from the observed numerical distribution of planets of small apparent size our imaginary shortlived observer should infer (wherein he would be right) that these bodies are more closely grouped in actual space than the larger planets. He might even infer that they formed a ring as they actually do, only he would be entirely mistaken as to the position of that ring. (He would set it far beyond the paths of Jupiter and Saturn.) Moreover he would infer, also rightly, that at the time of observation some parts of the regions occupied by these smaller looking planets were more richly strewn than others,—in other words that the average space allotted to each of them was less than elsewhere.

The conclusions to which Sir W. Herschel had thus been led were true, but they were only a part of the truth, and thus made in company with the unsound principle he had adopted, they became part of an entirely erroneous theory of the stellar universe, precisely as the conclusions of our imagined "astronomer of a day," respecting the distribution of the asteroids in a ring-shaped region of their own would be true in themselves, but only part of the truth, while combined with the theory that all the planets are of about the same size, these true conclusions would become part of the entirely erroneous theory that the asteroids form a gigantic ring of planets far outside the larger looking planets, Jupiter and Saturn.

And now Sir William Herschel made a discovery which should have shown him the incorrectness of his general principle, and would certainly have done so had he made it ten years earlier, just as a kindred discovery did earlier lead him to correct a kindred error of principle, and as the recognition of a kindred truth by Sir John Herschel later led him also to correct the very error of principle which now led Sir William astray.

When Sir W. Herschel had earlier found that in certain regions of the heavens the stars are more richly gathered in mere number than elsewhere, he did not fail to see that they must form a rounded cluster. He felt that the increase in the number of stars on a region round in *apparent* shape could not reasonably be explained as due to the enormous extension of the system of stars in that particular direction, the chances being so enormous against the extension lying in a direction tending exactly from the solar system. If it were conceivable in a single case that the stars seen in a round-shaped region of the sky really occupied an enormously long, cylindrical region of space, the axis of the cylinder tending directly towards the sun, it could not be supposed that in a second case, and in fact in several cases, cylindrical star clusters chanced to occupy the same singular and unlikely position. Besides which, he would probably have rejected the very idea of cylindrical star clusters as absurd on the face of it.

Yet now, when using the space-penetrating method instead of the star-gauging method, he comes on evidence pointing exactly the same way, he no longer with his former clearsightedness sees at once what the evidence means, but he interprets the evidence by the very principle which as a matter of fact that evidence overthrew.

(To be continued.)

THE PATENT ACT OF 1883.

By Polyglot.

ON the 1st of January last came into force a new law relating to patents, trade-marks, and designs. Inventing is eminently the failing of the thinking part of humanity, and, as a desire to "patent" is its direct offspring, a concise practical explanation of the principal provisions of the present law cannot be out of place in this paper, which is expressly intended for people with brains. Therefore, *Salve, lector.*

The new Patent Act, like all innovations of importance, has been hailed with much enthusiasm by some, with much obloquy from others; yet it does not wholly deserve either. That it is a great boon in many respects is evidenced by

the great increase in the number of applications for patents. There have been four times as many in the first quarter of the current year as in the corresponding part of the last, and it is worth mentioning that this increase seems permanent, and will very probably gain volume when the practice under the new conditions is fully settled, and when obscure parts of the Act are cleared by judicial decisions.

For the purpose of this present paper it may be as well to consider the provisions of this law in the order in which they will come home to the inventor and patentee. The first question, therefore, is, What constitutes a patentable invention?

An invention, referring of course not to the process of excogitation, but to its result, may be one of several things, viz. :—

A new device, appliance, or apparatus, or a set of all or any of these serving to produce a known result.

A new method or process, or a novel manner of proceeding by known means a known result.

A novel article of manufacture obtained either by known or by novel means and methods.

Or, lastly, a combination of several of the foregoing.

In considering whether an invention possesses such novelty as will enable it to serve as the subject-matter for a patent, we must not assume that it is enough if the inventor has been previously unacquainted with that which he alleges to have invented, but that part of the public which are most likely to know things of the same character must not have, at the time of the application for a patent, been to such an extent aware of the invention, as to be able to practise it. Another condition is that the inventor shall not have worked his invention for profit (not made or sold articles made according to the same) nor publicly exhibited it, or described it in any publication before the date of his application for letters patent, nor must this have been done by any one else. This does not, however, preclude him from making the invention known to trustworthy persons binding them to secrecy. Publication outside the British Isles does not in any way affect the question.

Novelty alone is, however, not sufficient to entitle an inventor to a patent; another element is required, and this is utility of the invention. This means that the public derive or may derive some benefit by the use of the patented idea. The benefit may be cheapness, better quality, or greater convenience in use, or, in fact, any similar advantage. I think that, if the thing "sells," this would be held *ipso facta* proof of utility, even were the article a mere toy, like the—happily defunct—cri-cri, which the public took such a violent fancy for some ten years ago. It might be said that, by using the invention during the term of the patent solely for his own gain, the inventor really precludes the public from deriving profit from the invention; but, as the latter becomes the property of the world at large on the expiry of the term, this would be no objection, the more so as the exclusive enjoyment for a limited time is really the consideration for the disclosure of the invention.

The next consideration is, who is entitled to the patent? Clearly nobody but the inventor; or, if several persons jointly make an invention, all those (and they only) who are thus concerned in the invention. This is the theory, but, as it is often desirable for the inventor to associate himself with others in patenting and subsequently utilising the invention, the new law provides that the patent may be granted to him and his one or more associates jointly. It must, however, in such a case, clearly appear on the face of the application who has made the invention. If the inventor does not reside within the British Isles, the patent may be obtained by any person to whom he communicates his invention. This, in many cases, is a great convenience. I think, however, that the law ought clearly to state that a patent thus obtained is only to be held by the communicant in trust for the communicator, unless there is an understanding to the contrary. As the law actually stands, the patentee becomes the absolute owner of all the rights in the invention. It has been urged that communication patents ought to be abolished, because an unscrupulous person learning some new invention may go out of the country for a short time, cause the patent to be obtained by an agent (who may act in perfect good faith) in this country, and thus cheat the rightful inventor by avoiding the declaration. I think that the force of this reasoning is in great part, if not wholly, imaginary. If a man is unscrupulous enough to appropriate what is not his (whether it is a silver spoon, a slice off the village common, or an invention), he will certainly not hesitate about a bit of perjury, particularly as it is extremely difficult to prove that a man has not made a certain invention.

When the inventor has fully made up his mind on the points which I have already put before the reader and resolved to obtain a patent, he will naturally be desirous of knowing how to proceed. I may here state my conviction that the best course in ninety-nine cases out of a hundred is to put the matter into the hands of a patent agent of good repute. In this, as in all other matters, a skilled and practised specialist is sure to know more about the procedure, the manner of drawing up the requisite documents, and, above all, will know better how much to say and how much to leave unsaid, than any person, howsoever gifted, who for the first time (ay, and for the tenth) meddles with the thing in a tentative and uncertain way. Unfortunately, there are as many black sheep amongst patent agents as in other classes of men. It is not seemly for me to recommend any one firm; but I think I may be allowed to state that, if a patent agent is a member of the "Institute of Patent Agents," he is sure to be known to his brethren in the profession as an honest and upright man. I am in fairness bound to say that there are honest patent agents outside the "Institute" also, and that the fellowship of the "Institute" is not necessarily a guarantee of that degree of skill which I should seek for in applying to an agent; but at the same time it is not over-easy for an incapable man, and probably almost impossible for a rogue, to be admitted to the "Institute."

Nevertheless, the inventor may wish to do the work himself; if so, he will in the following lines find information which, I venture to hope, will be useful to him.

I will not occupy valuable space by quoting forms, but assume that these are already obtained either from the patent office authorities, through the post-offices who are supposed to sell them (I never tried the post-offices myself), or from a law stationer, a few amongst whom keep a stock of all the requisites for our purpose.

The declaration is easily filled up, the marginal directions are so clear that with a little common sense it is almost impossible to make a mistake. The only point to be noted is the title. Do not make it so short as make it meaningless, nor burden it with irrelevant verbiage. I will illustrate my meaning by a concrete example. If you have invented a process of making dry-plates, and if there be no novelty excepting that, do not call your invention "Photography." That is a title broad enough collectively to cover every method, and all the appurtenances used in the art. On the other hand, if you have invented new methods, not only of making dry-plates, but also of developing, printing, and, perhaps, even of mounting the prints, do not call your invention "Smith's dry plate." Your title ought to be

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such as fairly to lead to the inference of all that is to be comprised in the patent, and "Smith's dry-plate" assuredly does not suggest that there are an albuminised paper and a special toning solution and other things besides Your title is, moreover, not an advertisement, and, therefore, no benefit is to be gained by encumbering it with any "fancy" name. Avoid barbarities, such for instance as the following:—

"A perfect improved musical instrument, to be called De Johnson-Brown's Tonic-sol-fa Musarion Jews-harp and Mouth-organ combined."

I know that this sounds incredibly stupid, but I can without difficulty find many parallels to it in the patent office records. Remember, if vanity makes you anxious to see your name in print, that not only will the title of the invention, together with your full name, and address, and the number and date of your application, appear in the official journal, but that most likely not one man in a thousand ever sees this publication unless special business causes him to do so. If you want the fancy name protected, you must register it as a trade mark, which is quite a different matter.

(To be continued.)

COINCIDENCES AND SUPERSTITIONS.

By R. A. Proctor.

(*Continued from page* 281.)

THERE arises, in certain cases, the question whether coincidences may not appear so surprising as to justify the assumption that they are due to a real though undiscerned association between the coincident events. This, of course, is the very basis of the scientific method; and it is well to notice how far this method may sometimes be unsafe. If remarkable coincidences can occur when there is no real connection—as we have seen to be the case—caution must be required in recognising coincidence as demonstrative of association.

Not to take any more scientific instances, of which perhaps I have already said enough, let us consider the case of presentiments of death or misfortune. Here, in the first place, the coincidences which have been recorded are not so remarkable as might at first sight appear, simply because such presentiments are very common indeed. A certain not unusual condition of health, the pressure of not uncommon difficulties or dangers, depression arising from atmospheric and other causes, many circumstances, in fact, may suggest (and do notoriously suggest) such presentiments. That some presentiments out of very many thus arising should be fulfilled is not to be regarded as surprising—on the contrary, the reverse would be very remarkable. But again a presentiment may be founded on facts, known to the person concerned, which may fully justify the presentiment. "Sometimes," says De Morgan on this point, "there is no mystery to those who have the clue." He cites instances. "In the *Gentleman's Magazine* (vol. 80, part 2, p. 33) we read, the subject being presentiment of death as follows:—'In 1718, to come nearer the recollection of survivors, at the taking of Pondicherry, Captain John Fletcher, Captain De Morgan'" (De Morgan's grandfather), "'and Lieutenant Bosanquet each distinctly foretold his own death on the morning of his fate.' I have no doubt of all three; and I knew it of my grandfather long before I read the above passage. He saw that the battery he commanded was unduly exposed—I think by the sap running through the fort when produced.* He represented this to the engineer officers, and to the commander-in-chief; the engineers denied the truth of the statement, the commander believed them, my grandfather quietly observed that he must make his will, and the French fulfilled the prediction. His will bore date the day of his death; and I always thought it more remarkable than the fulfilment of his prophecy that a soldier should not consider any danger short of one like the above sufficient reason to make his will." "I suppose," proceeds De Morgan, "the other officers were similarly posted. I am told that military men very often defer making their wills until just before an action; but to face the ordinary risks intestate, and to wait until speedy death must be the all but certain consequence of a stupid mistake, is carrying the principle very far."

As to the fulfilment of dreams and omens, it is to be noticed that many of the stories bearing on this subject fail in showing that the dream was fully described *before* the event occurred which appeared to fulfil the dream. It is not unlikely that if this had been done, the fulfilment, in many cases, would not have appeared quite so remarkable as in the actual narrative. Without imputing untruth to the dreamer, we may nevertheless—merely by considering what is known as to ordinary testimony—believe that the occurrences of the dream have been somewhat modified after the event. I do not doubt that if every person who had a dream leaving a strong impression on the mind, were at once to record all the circumstances of the dream, very striking instances of fulfilment would occur before long; but at present, certainly, nine-tenths of the remarkable stories about dreams fail in the point I have referred to.

The great objection, however, to the theory that certain dreams have been intended to foreshadow real events, is the circumstance that the instances of fulfilment are related, while the instances of non-fulfilment are forgotten. It is known that instances of the latter sort are very numerous, but what proportion they bear to instances of the former sort, is unknown; and while this is the case, it is impossible to form any sound opinion on the subject, so far as actual evidence is concerned. It must be remembered that in this case we are not dealing with a theory which will be disposed of if one undoubted negative instance be adduced. It is very difficult to draw the line between dreams of an impressive nature—such dreams as we might conceive to be sent by way of warning—and dreams not specially calculated to attract the dreamer's attention. A dream which appeared impressive when it occurred, but was not fulfilled by the event, would be readily regarded, even by the dreamer himself, as not intended to convey any warning as to the future. The only way to form a just opinion would be to record each dream of an impressive nature, immediately after its occurrence, and to compare the number of cases in which such dreams are fulfilled with the number in which there is no fulfilment. Let us suppose that a certain class of dreams were selected for this purpose. Thus, let a society be formed, every member of which undertakes that whenever on the night preceding a journey he dreams of misfortune on the route, he will record his dream, with his ideas as to its impressiveness, before starting on his journey. A great number of such cases would soon be collected, and we may be sure that there would be several striking fulfilments, and probably two or three highly remarkable cases of this sort; but for my own part, I strongly entertain the

* De Morgan writes somewhat inexactly here for a mathematician. The sap did not run through the fort, but the direction of the sap so ran.

opinion that the percentage of fulfilments would correspond very closely with the percentage due to the common risks of travelling, with or without premonitory dreams. This could readily be tested, if the members of the society agreed to note every occasion on which they travelled: it would be found, I suspect, that the dreamers gained little by their warnings. Suppose, for instance, ten thousand journeys of all sorts were undertaken by the members of the society in the course of ten years, and that a hundred of these journeys (one per cent., that is) were unfortunate; then, if one-tenth of the journeys (a thousand in all) were preceded by warning dreams, I conceive that about ten of these warnings (or one per cent.) would be fulfilled. If more were fulfilled there would appear, as far as the evidence went, to be a balance of meaning in the warnings; if fewer, it would appear that warning dreams were to some slight degree to be interpreted by the rule of contraries; but if about the proper average number of ill-omened voyages turn out unfortunately, it would follow that warning dreams had no significance or value whatever: and this is the result I should expect.

Similar reasoning, and perhaps a similar method, might be applied to cases where the death of a person has been seemingly communicated to a friend or relative at a distance, whether in a dream or vision, or in some other way, at the very instant of its occurrence. It is not, however, by any means so clear that in such instances we may not have to deal with phenomena admitting of physical interpretation. This is suggested, in fact, by the application of considerations resembling those which lead to the rejection of the belief in dreams giving warning against dangers. Dreams of death may indeed be sufficiently common, and but little stress could be laid, therefore, on the fulfilment of several or even of many such dreams. But visions of the absent are not common phenomena. That state of the health which occasions the appearance of visions is unusual; and if some of the stories of death-warnings are to be believed, visions of the absent have appeared to persons in good health. But setting aside the question of health, visions are unusual phenomena. Hence, if any considerable proportion of those narratives be true, which relate how a person has at the moment of his death appeared in a vision to some friend at a distance, we must recognise the possibility, at least, that under certain conditions mind may act on mind independently of distance. The *à priori* objections to this belief are, indeed, very serious, but *à priori* reasoning does not amount to demonstration. We do not *know* that even when under ordinary circumstances we think of an absent friend, his mind may not respond in some degree to our thoughts, or else that our thoughts may not be a response to thoughts in his mind. It is certain that such a law of thought might exist and remain undetected—it would indeed be scarcely detectible. At any rate, we know too little respecting the mind to be certain that no such law exists. If it existed, then it is quite conceivable that the action of the mind in the hour of death might raise a vision in the mind of another.*

I shall venture to quote here an old but well-authenticated story, as given by Mr. Owen in his "Debatable Land between this World and the Next," leaving to my readers the inquiry whether probabilities are more in favour of the theory that (1) the story is untrue, or (2) the event related was only a remarkable coincidence between a certain event and a certain cerebral phenomenon, in reality no way associated with it, or (3) that there was a real association physically explicable, or (4) that the event was supernatural. Lord Erskine related to Lady Morgan—herself a perfect sceptic—(I wish, all the same, that the story came direct from Erskine) the following personal narrative:—"On arriving at Edinburgh one morning, after a considerable absence from Scotland, he met in the street his father's old butler, looking very pale and wan. He asked him what brought him to Edinburgh. The butler replied, 'To meet your honour, and solicit your interference with my lord to recover a sum due to me, which the steward at the last settlement did not pay.' Lord Erskine then told the butler to step with him into a bookseller's shop close by, but on turning round again he was not to be seen. Puzzled at this he found out the man's wife, who lived in Edinburgh, when he learnt for the first time that the butler was dead, and that he had told his wife, on his death-bed, that the steward had wronged him of some money, and that when Master Tom returned he would see her righted. This Lord Erskine promised to do, and shortly afterwards kept his promise." Lady Morgan then says, "Either Lord Erskine did or did not believe this strange story: if he did, what a strange aberration of intellect! if he did not, what a stranger aberration from truth! My opinion is that he *did* believe it." Mr. Owen deals with the hypothesis that aberration of intellect was in question, and gives several excellent reasons for rejecting that hypothesis; and he arrives at the conclusion that the butler's phantom had really appeared after his death. "The natural inference from the facts, if they are admitted, is," he says, "that under certain circumstances, which as yet we may be unable to define, those over whom the death-change has passed, still interested in the concerns of earth, may for a time at least retain the power of occasional interference in these concerns; for example, in an effort to right injustice done." He thus adopts what, for want of a better word, may be called the supernatural interpretation. But it does not appear from the narrative (assuming it to be true) that the butler was dead at the moment when Erskine saw the vision and heard the words. If this moment preceded the moment of the butler's death, the story falls into the category of those which seem explicable by a physical theory,—as by the theory of brain-waves. I express no opinion.

(To be continued.)

* I remind the reader that this article is from my "Borderland of Science," (now out of print,—whatever advertising columns may say—and not to be reprinted); and that the opinions above quoted were expressed by me in the *Cornhill Magazine* many years ago.

WIREWORMS AND SKIPJACKS.

By E. A. Butler.

IN turning up the soil round garden plants, we sometimes find a stiffish, elongate, shiny, yellowish-brown, worm-like thing, about the thickness of a stout pin, and about three-quarters of an inch in length. Under the impression that any living creature found in garden-soil is an intruder that should be summarily disposed of, we may proceed to endeavour to put these ideas into practice, only, however to find that this is not quite so easy a matter as it

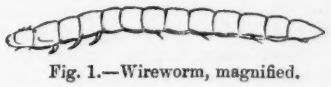


Fig. 1.—Wireworm, magnified.

seemed; the thing is so stiff and tough, that even a good hard squeeze seems to make but little impression on it. This tough, worm-like thing is a wireworm (Fig. 1), and so

dire a foe is it to vegetation, that we are perfectly justified in making all efforts to despatch it. On examining it more closely, we find that it is not truly cylindrical, like a piece of wire, but somewhat flattened beneath, and that it is made up of a series of thirteen segments, placed in line, one behind the other. The first of these is the head, and the next three carry six short legs, one on each side of each segment, with which the creature crawls along, trailing the remainder of its body after it. The head is black, and is furnished with a pair of stout, transversely-moving jaws, and a pair of short antennæ.

Wireworms are the larvæ of various kinds of beetles, called "skipjacks" or "click-beetles," from a peculiar habit of springing up into the air, and, at the same time, producing a sharp clicking sound. Skipjacks are narrow, elongate insects, with short legs and hard integuments

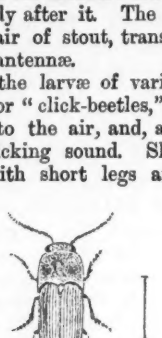


Fig. 2.—Click Beetle. *Agriotes obscurus.*

(Fig. 2). The head is small and often much sunk into the thorax, and carries a pair of long, distinctly jointed antennæ; the thorax is of large size, and, roughly speaking, more or less quadrangular in outline, and convex above and beneath. The elytra or wing-cases cover the body, and conceal a pair of ample membranous wings. Each is somewhat triangular in shape, and they form when closed a strongly arched, shield-shaped surface; they are usually marked longitudinally with parallel grooves or furrows, and covered more or less densely with short hairs. The under-surface also is strongly convex, and the legs are short, and capable, like the antennæ, of being folded close up to the body. When thus compactly folded up, the insect may easily be mistaken for a piece of stick or earth. When surprised or alarmed, it will thus feign death, relaxing its hold of what it may have been clinging to, and falling to the ground, as often as not, on its back.

Now usually, when a beetle gets into such a position, it frantically waves its legs about till one of them by chance strikes the ground; then, seizing any irregularities of surface with the sharp claws at the end of its feet, and assisting itself with the end of its shanks, it levers itself over sideways. But, owing to the convexity of its back and the shortness of its legs, a skipjack is unable to use this method, unless there happen to be close to it some objects of sufficient height to be reached by its waving legs; failing this, however, it would be, were it not for a remarkable contrivance, as helpless as a turtle in a similar position, and would stand a good chance of being doomed to continue its unavailing struggles, at the mercy of any passing foe, till exhaustion ended its woes by death. The contrivance is as follows:—The hinder edge of the thorax is produced in the middle underneath into a long curved blunt spine, which is received into a little pit at the base of the body. The thorax is loosely articulated to the abdomen, and can be freely moved up and down like the lid of a box on its hinge. When on its back, therefore, the skipjack arches its body by bending its thorax backwards, and so balances itself on the two extremities of its body; this movement releases from its hollow the spine above referred to. Having stretched itself to the utmost in this attitude, the insect suddenly and forcibly resumes its former supine position—a movement which has the effect of causing it to rebound from the ground and shoot upwards into the air to the height of several inches, at the same time bringing the spine back into its sheath with a sharp clicking sound. On returning to the ground, the insect generally manages to land itself right side up; if not successful the first time, however, it renews the attempt, and continues skipping till the desired result is obtained.

About 60 species of skipjacks belong to the British Fauna, and three or four of them, brownish insects belonging to the genera *Athous* and *Agriotes* are exceedingly common; the latter genus furnishes the most destructive wireworms. In their larval existence they are subterranean in habits, living for several years a little below the surface and spending their time in devouring the roots and underground stems of plants, and thus, of course, doing much more harm than can be measured by the amount of matter actually devoured. In the winter they retire to a greater depth, descending farther and farther as the frost increases, and pausing in their depredations only in the coldest weather. They devour all kinds of agricultural produce, destroying both root, grain, and fodder crops. Carrying on the ravages as they do in the complete obscurity of subterranean life, they are rarely detected when at work, and the first evidence that the fatal work has been done is seen in the apparently causeless withering of the plants.

It is fortunate that creatures so destructive have natural enemies. Among the most important of these is the mole, which devours the larvæ with avidity. It is aided in its praiseworthy efforts by several kinds of birds, such as rooks and lapwings. A variety of artificial remedies have been proposed for checking the spread of the mischief, such as the application of liquid manure, which has the twofold effect of strengthening the plants that have not been irreparably injured, and driving away or killing the wireworms; paring off a thin coating of the soil, which will contain most of the insects, and then burning it; imbedding in the soil at short distances apart slices of carrot and turnip to serve as traps, and then examining them and destroying the wireworms every other day. The latter method has been found serviceable in hop-grounds, as many as 150 wireworms having been trapped close to a single hop-hill. It should be remembered in this connection that the abundance of many agricultural pests is due in great measure to man himself. We greatly increase the supply of suitable food for these creatures, and in other ways make the surroundings more and more favourable to their existence, and we need not wonder, therefore, that the inevitable result follows, and that the additional task devolves upon us of devising means to counteract the excessive development we have ourselves unintentionally occasioned.

The group to which these insects belong possesses a few British representatives of considerable brilliance in colouring, but they are far surpassed, both in beauty and in size, by exotic forms, some of which are amongst the most brilliant of all beetles. To this group, also, belong the well-known and remarkable Fire-flies of the West Indies, not to be confounded with the Lantern-flies, which are members of a widely-different order of insects, the Homoptera. The light emitted by fire-flies proceeds from two patches on the thorax and from others concealed beneath the elytra when they are closed, but rendered visible when they are spread for flight. An old writer, Pietro Martire, gives the following quaint account of a method of catching these creatures: "Whoso wanteth cucuij, goeth out of the house in the first twilight of the night, carrying a burning firebrande in his hande, and ascendeth the next hillock that the cucuij may

see it, and hee swingeth the firebrande about, calling cucuius aloud, and breaketh the ayre with often calling and crying out 'cucuie, cucuie!' Many simple people suppose that the cucuij, delighted with that noise, come flying and flocking together to the bellowing sound of him that calleth them, for they come with a speedy and headlong course, but I rather think that the cucuij make haste to the brightness of the firebrande, because swarmes of gnattes fly into every light, which the cucuij eat in the very ayre, as the martlets and swallowes doe. Some cucuius sometimes followeth the firebrande, and lighteth on the grounde; then he is easily taken, as travellers may take a beetle, if they have need thereof, walking with his wings shut. In sport and merriment, or to the intent to terrify such as are afrayed of every shadow, they say that many wanton, wild fellowes sometimes rubbed their faces by night with the fleshe of a cucuius, being killed, with purpose to meet their neighbours with a flaming countenance, as with us wanton young men, putting a gaping vizard over their face, endeavour to terrify children or women who are easily frighted."

VESTIGES OF CREATION.*

I AM glad that the authorship of this fine work has been at length publicly acknowledged. It has long been an open secret; yet many, not knowing the facts of the case, exercised their minds over the matter as a puzzle, and formed strange theories about the work. I was myself offered an elaborate MS. proving that Robert Chambers could not have been the author of the "Vestiges," and "going near to prove" that the author was no other than Sir Charles Lyell. But my real reason for rejoicing that the book has now been definitely assigned to its real author is that the world owes very much to him for this admirable work. Boldly conceived, effectively treated, and admirably written, the book has done more good than hundreds of volumes by the working section of scientific inquirers. It has been found easy to point to errors in matters of detail, especially in the earlier editions, but those men of science who most carefully indicated mistakes in points of detail,—from which their own works were doubtless freer, could not see that the work presented justly a great general truth which they had failed entirely to grasp. Robert Chambers, compared with Prof. Sedgwick and the rest who so scathingly denounced him for errors of detail, might be compared to an architect who should be ridiculed for mistakes about details of mason-work. He selected, here and there, materials which were not so good as he had supposed. But the beauty of the edifice he reared was not impaired by such mistakes as those. His scientific critics on the other hand, collected excellent materials for a great work; but they had no more idea how to plan such a work than the mason has respecting the architectural details suitable for a noble temple.

Robert Chambers himself was surprised at the hostility to his views shown by many men of science. He seems to have expected to find "many men of science" to be great, like those who erect a grand edifice of science, and falling back to look at it feel like archangels, as Wendell Holmes has finely said. But nine out of ten of them, nay ninety-nine out of a hundred, are either but as the working masons, or put together—far from the real temple of science, of whose proportions and beauty they know nothing,—the mere fittings and ornaments of the temple. Chambers presently felt how the case really was. He had felt "embarrassed in presenting himself in direct opposition to so many men possessing talent and information." But being led by his study of the great problems of nature in their nobler aspect, to consider the work of those who analyse the details of natural phenomena, he saw the truth. In words deserving of most careful study, he shows why so many men of science disapproved of views which now are (in their general aspect) the accepted truths of science. "The ability of the purely"—he might have said rather the "narrowly"—"scientific class to give at the present time a true response" to the great question he had propounded, "appears extremely challengeable. It is no discredit to them that they are, almost without exception, engaged each in his own little department of science, and able to give little or no attention to other parts of that vast field. From year to year, and from age to age, we see them at work, adding no doubt much to the known, and advancing many important interests, but at the same time doing little for the establishment of comprehensive views of Nature. *Experiments in however narrow a walk, facts of whatever minuteness, make reputations in scientific societies:* all beyond is regarded with suspicion and distrust."

It is gratifying to consider, however, that despite the inane enmity of those who imagined that the grand and elevating views in the "Vestiges" were in some way opposed to religion, and the torpid hostility of the scientific detail-workers, the work made its influence felt at once. If Chambers was pained sometimes at the virulence of the attacks made on his book, he recognised all the time that the very violence of these attacks showed how his work was telling. It was reaction, equal and opposite to action, and being energetic showed that it was aroused by most effective work.

It would be difficult to say how much of the freedom and strength of men's present modes of thought in these matters is due to Robert Chambers. The mere number of readers of his book, though they were to be counted probably by hundreds of thousands, would give no true measure of its influence. Other books, in some respects more valuable (though they have done no such good work), have replaced the "Vestiges." Our Lyells, who at first were deterred by just scientific objections from accepting the particular mode of development indicated by Chambers, have been able to accept what was after all the vital principle of his work, so soon as our Darwins and Wallaces showed (at least in part) what the real system of development is. The principle of Chambers's book,—no new principle in fact, but newly presented as advanced by him—lies at the very foundation of all our recent treatises on biology, geology, physiology, and psychology. Darwin's works may be regarded as owing the just esteem in which they are held to this chiefly—that they show *how* the process of development has gone on of which Chambers had only been able to show that it certainly has been and is the great law of the universe. In Mr. Spencer's works alone of all those in which the doctrine of development has been advanced is a wider field entered and surveyed than that which Robert Chambers entered, and which Darwin, Wallace, Huxley, and their fellow-workers have partly surveyed.

Of the attacks made on the "Vestiges of Creation" by the unbelieving crew who shuddered at the thought that the laws seen around us on the small scale extend to all nature on the fullest scale, it is hardly necessary to speak. These poor in soul we have always with us. They are always in a state of alarm lest "some hysteric sense of

* "Vestiges of the Natural History of Creation." By Robert Chambers, LL.D. Twelfth Edition. With an introduction relating to the authorship of the work, by Alexander Ireland. (W. & R. Chambers, London and Edinburgh.)

wrong or insult should disturb the throne where Wisdom reigns Supreme," and lest *they* should be punished because others reject the strange god which they have made after their own likeness. To them as science reveals more and more of the mysterious glory of the universe, and as the dread of Infinite Law falls more heavily on their souls, we may say—(though it will avail nought)—"O, ye of little faith, wherefore do ye fear?" Shuddering as they stumble along in the rear of the thought of their age, these feeble and fearful ones raise their shrieks of mingled anger and alarm, as science steps confidently onwards. They ever dread lest science should rashly tread on forbidden ground. They need not fear. Science has long since put the shoes from off her feet in full consciousness that wherever her footsteps may tread, the ground on which she stands is holy ground. But she has no fear lest the Holy of Holies should be reached. She has long since learned that

"End there is none to the Universe of God: lo! also there is no beginning."

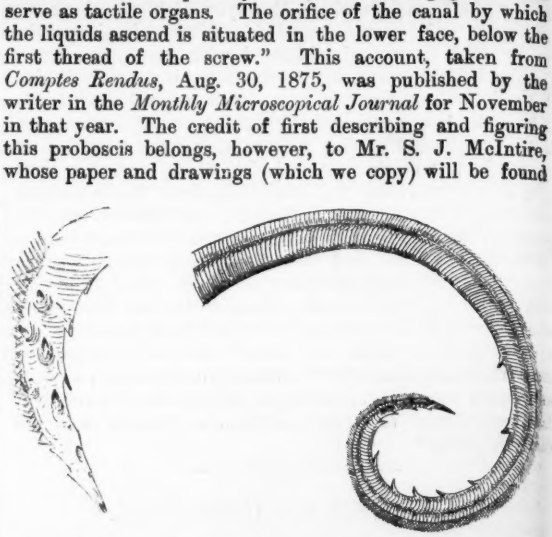
Richard A. Proctor.

PLEASANT HOURS WITH THE MICROSCOPE.

By Henry J. Slack, F.G.S., F.R.M.S.

In former papers of this series, the mouth-organs of some interesting insects have been described. In the Breeze Flies, we found an alarming set of knives and saws, adapted to pierce the skin of such animals as the horse; in bees, the biting mandibles are not directly concerned in obtaining the creature's food, but other mouth parts are developed to form a long tongue, with which the nectar of the plants is both swept up and sucked in. Wasps, we found with stronger biting mandibles, and a much shorter tongue. In the butterfly and moth groups the mandibles are long and pliable, and when pressed together make a sucking-tube able to reach deep down in the corolla of flowers. It used to be thought that no member of these groups was furnished with the means of piercing through any tough substance; but if there is no breach in the continuity of nature, it would be expected that either in living or extinct species some connecting-links between different kinds of sucking and biting, or rather piercing, insects would be discovered, and the Lepidoptera would not appear an isolated group.

Entomologists, however, did not, a little while ago, reason in this way, and in 1871, when a French botanist, named Thozet, who had established himself in Roehampton, a little town on the Tropic of Capricorn, in Australia, accused a lepidopter, belonging to the genus *Ophideres*, of perforating oranges to feed upon their juice, he met with no attention. M. Thozet sent specimens to Herr Künckel, who made no proper examination of them until 1875, when he saw in the *Capricornian*, a Roehampton paper, an anonymous account of the damage done to the fruit by *O. Fullonica*. The German naturalist then examined the specimens sent him, and found them provided with a proboscis, which he thus described:—"The two adpressed maxillæ terminate in a sharp triangular point, furnished with two barbs. They then swell out, and present on the lower surface three parts of the thread of a screw, while their sides, on the upper surface, are covered with short spines, springing from a depression with sharp, hard sides. These spines are to tear the cells and the pulp of the oranges, as a rasp opens those of beetroot to extract the sugar. The upper portion of the proboscis is covered from below and on the sides with fine serrated striæ, disposed in a half helix, which give it the properties of a file. These striæ are from time to time interrupted by small, non-resisting spines which serve as tactile organs. The orifice of the canal by which the liquids ascend is situated in the lower face, below the first thread of the screw." This account, taken from *Comptes Rendus*, Aug. 30, 1875, was published by the writer in the *Monthly Microscopical Journal* for November in that year. The credit of first describing and figuring this proboscis belongs, however, to Mr. S. J. McIntire, whose paper and drawings (which we copy) will be found



in the *Monthly Microscopical Journal* for May, 1874. Mr. McIntire was engaged in studying the scales of the Lepidopters, and among a lot of damaged specimens, said to have come from West Africa, he found a brown moth with the peculiar apparatus. He at once divined the use of this unusual implement. He saw that it could pierce most vegetable structures, and that, after penetration had been effected, the recurved spines would act as holdfasts and allow the creature to take his food in a leisurely way. He added that "the unwary captor of such a moth might find, to his surprise, that it could, in self-defence, inflict a puncture of his skin by no means insignificant."

A few years ago, Mr. Reginald Reid, of Sydney, was kind enough to send me a mounted specimen of this proboscis, which is a most interesting object. The hairiness of the terminal part of the organ reminds one of the bee's tongue. When a ripe orange is punctured by the boring-tools, the juice must flow freely, and the mop-like part of the organ must be just the thing to take it up. The spines which Mr. McIntire figures as rising out of depressions, suggest, when seen under a magnification of about 100 linear, that they *may* be movable from their base, and thus oppose less obstacle to the withdrawal of the organ when the meal is over. The other spines have cutting edges on both sides, so that they could make their way in or out with about equal facility.

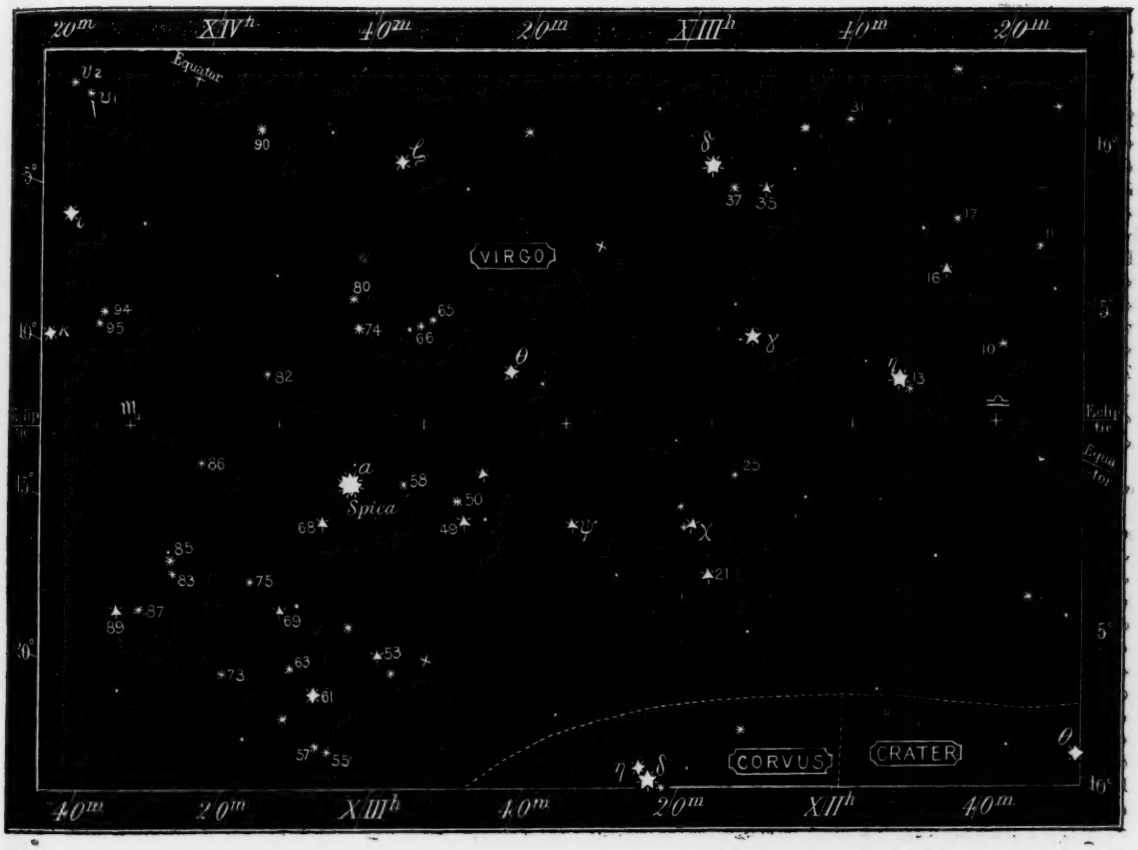
As Knowledge goes all over the world, I hope observers in various climes will look out for other *Ophideres*, and for any other Lepidopters of a like character. The creature must be tolerably easy to watch and to catch during its attack upon orange, and perhaps other fruit gardens, when once its feeding-times are known. Herr Künckel studied *O. Salaminia*, *O. materna*, and *O. imperator*, as well as *O. Fullonica*, and found all supplied with the same sort of tool.

Mr. McIntire's moth was drab coloured, inclining to reddish-brown, and about 2½ in. across the wings. He found the proboscis stout in proportion to its length. This could not be said of the specimen I received from Mr. Reginald Reid. So far as I am aware, no addition has been made to the information given by Mr. McIntire, and Herr Künckel, and it is important to stimulate further search. A proboscis adapted to piercing as well as sucking is found amongst the *Hemiptera* and the *Diptera*, but the

exact way the two functions are provided for in the *Ophideres* could not be an abrupt variation from any form hitherto known. There must have been, and probably still are, extant, a series of modifications leading through the great orders of insects from an early pattern of mouth-organ, through all the modifications that now exist. Even in butterflies the antiia, or proboscis, is not always alike. In *Vanessa atalanta* (red admiral), for example, the two elongated maxillæ are supplied towards their tips with a great number of little elongated barrel-shaped bodies terminated by smaller papillæ, which are thought to be taste-organs. In the common white butterflies they are scarcely perceptible.

Mr. Newport, writing in the "Cyclopædia of Anatomy and Physiology" concerning the mode in which the fluid food of the Lepidopters is made to ascend up their proboscis, stated that he gave sugared water, coloured with indigo, to two specimens of *Pontia rapi* (cabbage butterfly), and that he could see, under the microscope, the syrup went up in quick streams for one or two seconds, as if pumped up energetically, and then the motion was slower for an interval. He conceived that when the insect alights on a flower, it makes a strong expiration, which sends air out of the tracheal tubes of the proboscis, and out of those in the œsophagus, alimentary canal, and other parts. The inspiration which follows carries the fluid up, assisted by the action of the muscles of the proboscis. This is much more likely than an ascent of the fluid by capillary attraction, and corresponds with what appears when a bee is feeding and watched, as explained in a former paper.

If the reader compares one or two flexible maxillæ of the butterflies and moths with the stiff, knife-like ones of the Breeze Flies (as shown in a former number), he will see that the Lepidopter's organ is far more complicated. It is not only well supplied with the breathing-tubes—tracheæ—with their wonderful spirals to keep them open, but with a most elaborate and delicate system of muscles, which enable the instrument to be coiled up when not in use. Any part of an insect which abounds in tracheæ is sure to be the seat of some very active function, and, in the case of mouth-organs, to be connected with touch, or taste, as well as with a more mechanical use.



OUR NIGHT SIGN.

IN the map showing the Night Sign for April, certain details were left uncancelled which belong to the Day Sign for October. We therefore give the map, in its correct form, to make the series for the year complete. The star γ Virginis was inadvertently omitted.—R. A. PROCTOR.

ON the railways of the United Kingdom during the past year the grand total of accidents of all kinds to persons reached 1,167 persons killed, and 4,187 injured. Of this large number, only twenty-two were killed by accidents to trains, rolling stock, or permanent way. Eleven, or half of these, were railway servants, so that were it not for carelessness, thoughtlessness or suicides, the casualties on railways would be wholly insignificant.

ODD COINCIDENCES.

By Richard A. Proctor.

IF I believed in luck I might regard journeys into Birmingham as unlucky for me. It may be remembered that a few months ago I described how oddly I was removed from my proper carriage and put into one not going to Birmingham. I was all right and alone; *two* passengers got into a wrong carriage; a second class passenger was put into mine (first class) because of a loose coupling; and at the next station, a nervous station-master, wired to about the two wrongly-placed passengers, rushes to the wrong carriage, asks if we are for Birmingham instead of some other place, as he intended, and receiving "Yes" for reply, bundles us—the wrong passengers—into the carriage for that other place,—so that I get to Birmingham much later than I intended, and my companion, who had a special appointment there, finds it useless to go there at all, and returns home.

Well, last week running into Birmingham from Knowle, I narrowly escape "a real misfortune" as Mrs. Brown would say. I put down the bag containing the pictures for my lecture (the train was only to reach Birmingham five minutes before the lecture hour); go across a bridge to send off a telegram, and returning, enter train without my bag. I had not made such a mistake since February 3rd, 1881, when I let a train run out from Sacramento, Cal., with my lecture pictures. *That* time I was saved from shame and disaster, by a rainstorm so violent that my lecture had to be postponed; and by next day kind friends in the eastward bound train had sent back my pictures. *This* time, kind friends (one of them the same as in my Sacramento trouble) wired for my bag, and eventually it was brought in to me at the Birmingham Town Hall, just as I had gotten through the introductory part of my lecture.

This was rather an odd coincidence, but this was not the end of these Birmingham-nearing sorrows.

A few days later I am leaving Coventry for Birmingham, meeting my wife (from London) at the former station. "I will be careful," I remark to myself, "that no mistake of mine causes me any trouble." Vain hope! I see my heavier luggage labelled. On the arrival of the London train a lady and gentleman get out from the carriage in which my wife is sitting. They claim their smaller luggage, and my porter puts my precious lecture-bag on a seat. I turn to put my umbrella in the rack, or perchance to salute my wife. "There was our error, boys," as old Belarius says. "Oh, you mistook; you should have seized your bag" (as Milton does not say), I might have said to myself. But, unconscious of disaster, I begin to inquire about the little ones at home. In the midst of these domestic cares suddenly I miss my bag. You guess what had happened? A wretched porter, sent back by my wife's fellow travellers to see that nothing was left, had opened the door the instant my back was turned, and had seized *my* bag as his lawful prey!

We wired from Stetchford and anon from Birmingham. Reply comes, "All luggage put out at Coventry claimed by Mr. B., of So-and-So Park." More urgent telegrams bring us news that So-and-So Park is seven miles from station. How again the same good friend (and somewhat more) who at Sacramento had sent back my bag, and at Knowle had helped to restore it to me, had to go to Coventry,—while I lectured (*minus* some of my best pictures) at Birmingham—how Mr. B. had seen nothing of the bag, but how it turned up eventually along with his luggage, which had been sent unsorted to a lumber-room at the top of the house, need not here be told. The triple coincidence was complete, and I may hope to have no more trouble of the kind when nearing Birmingham. But I can understand how some folk get to imagine that particular places are unlucky to them.

Editorial Gossip.

The *Daily News* (May 1) remarks that "there are few innocent pleasures greater than yachting or coaching." Why the distinction? Are we to understand that guilty pleasures are greater than innocent pleasures? It is a singular doctrine, and moreover (a detail) untrue.

Colonel King-Harman described the Cremation Bill as "a crude attempt of scientific men to foist their opinions on the House" of Talk. Scientific men may be defined as men who are always wanting to know, and persons of Colonel King-Harman's turn of mind as folks who would much rather not know. Any attempt to teach such folk must of necessity be crude and ill-considered. I say this, only in relation to the worthy Colonel's general principle. As regards cremation it seemed, so far as Parliamentary talk over it went, to resolve itself into the question whether it was worse that many living should be poisoned than that a few who may have been poisoned should remain unavenged.

The real trouble about all questions of the disposal of the dead is that not one in a thousand really *feels*, as well as knows, that the dead body has no more real relation to its former occupant than the clothes he wore or than the arm-chair he used to sit in. If there was the slightest reason for imagining that the clothes of the dead might carry infection to the living no one would hesitate to burn them. If we cared to consider facts as they are we should think in like manner of the "muddy vesture of decay" which once did "grossly close in the defunct."

Mr. Herbert Spencer has recently directed attention to a point in connection with deaf-mutism which is of considerable importance. The inquiries of Tylor, Lubbock, and others, into the beliefs of savage races have not thrown so much light as could be wished on the degree to which religious ideas are entertained by races in various stages of savagery or on the origin of those ideas which appear to be most widely extended. Yet it seems clear that among the very lowest savages the idea of something other than body—call it soul, spirit, ghost, or what we will—has no existence. The phenomena of external nature, the occurrence of dreams, the remembrance of the dead, slowly arouse in savage races the conception of the immaterial, the sense of mystery, the hope of a hereafter, the idea of beings outside the sphere of cognition, and finally—after long processes of change and purification—faith in a Supreme Being. Without touching on the question of direct revelation, so much is certain and admitted by all, seeing that the facts lie before us. But many have naturally been led to ask what would happen if any members of civilised and advanced races could be allowed to grow to a knowledge of what modern science teaches about physical and physiological matters, but without any instruction in the religion of those around them. Would any intuitive perception of the immaterial appear? Would any religious conceptions, any ideas as to a future state, a Creator of all things, a Supreme Being Unknowable but necessarily Infinite in Power and Wisdom, manifest them-

selves? Mr. Spencer seems to think that we find an answer to this question in the case of intelligent deaf-mutes, who have remained through childhood and youth without any instruction because not as yet brought into communication with those around them by any substitute for spoken language which could properly introduce abstract ideas to their cognition. Whether this is so or not, the matter is clearly one of great interest, and now that so much is being done to give language to the deaf-mute, it might be interesting to ascertain what their ideas had been respecting the great mysteries of nature, or rather respecting the Mystery of Mysteries which we call the Unknowable. So far as is yet known it appears that the deaf-mute not only has no idea of a future state, but he has not even any idea of death,—a circumstance which should prevent any from hastily assuming that the absence of religious ideas in the case of the deaf-mute is evidence against their truth,—for death at any rate is certain, however unsuspected by the untaught deaf-mute. The Rev. Samuel Smith, who has been for 28 years in almost daily contact with deaf-mutes, says that in not a single instance has an uneducated deaf-mute been found to have "any conception of the existence of a Supreme Being as the Creator and Ruler of the Universe."

THE DISCOVERY OF "PRE-HISTORIC" REMAINS IN LINCOLNSHIRE.

IN KNOWLEDGE of May 2 a paragraph is given which first appeared in the *Banner*, "a Church and constitutional newspaper," relating to an alleged extraordinary discovery of neolithic works in the plain of the Ancholme, near Brigg. The report was communicated to the *Banner* by the Rev. C. W. Markham, rector of Saxby. At it was of a very extraordinary nature, I determined to seek further light upon the matter, not without a strong suspicion, founded partly on the source whence the intelligence came, and partly upon the wording of the paragraph, that it would turn out "a mare's nest." The case is not a little instructive as showing how cautiously statements about such matters ought to be received. I soon found that the folk in the neighbourhood of the supposed wonder were somewhat excited by the marvellous things they had been induced to believe concerning it. On the other hand, I found that people as experienced in such questions as members of the Government Geological Survey were indifferent about it. When writing to an intelligent tradesman in the locality, I mentioned that it had been reported to me that the cross-beams in the wooden way were secured by trenails inserted in *square* holes (evidently cut by a mortice chisel), I got the reply "that the Government Geological Surveyors have no information on the matter worth a button-top. They are mere surveyors; they know nothing of antiquities; nor are they acquainted with geology in its lessons—at least those with whom we have come in contact." This looked very funny—all the more so when I found that my correspondent, so far from believing in this as a neolithic structure, "of enormous age, *almost* beyond calculation," describes it as "one of those ancient ways placed over low and boggy places by the Romans, or perhaps Anglo-Saxons." This, to him, was almost as marvellous as if the work had been that of neolithic man! Hence his impatience with the "Geological Surveyors," who seemed to him to think too little of the discovery. The facts, as near as I can obtain them, are that the beams of oak were found associated with boughs of yew under six feet of (probably warp) clay with a peaty surface. There is no proof of the extension of the roadway beyond the excavation in which it was exposed. As to the Roman road, there are no traces of one above the planked way in the vicinity of the latter, but signs of Roman roads are said to have been found in surface peat higher up the Ancholme Valley. Two pins, or trenails, pass through each beam, one near each end, and the holes are *squared*. W. MAWER.

LOST-CAR agents, the *Railroad Gazette* says, find cars in all sorts of curious places; but Mr. Rogers, of the Pennsylvania Road, recently had an experience which was out of the way even for him. In search recently of two missing coal cars out in the flooded district in Ohio, he found one of them in a cornfield—which was not so uncommon—but soon after he found the other on the top of a tree.

THE FACE OF THE SKY.

FROM MAY 9 TO MAY 23.

BY F.R.A.S.

THE Sun will be the subject of daily examination whenever the sky is cloudless. The night sky is shown on Map V. of "The Stars in their Seasons." Mercury is indifferently placed for the observer to-day, and travelling towards his inferior conjunction (where he arrives at 10 o'clock at night on the 17th), he gets worse and worse in this respect. Venus is a magnificent object; by far the most brilliant and conspicuous in the night sky. She still does not set until well on towards midnight, and her glittering crescent forms a crucial test of the excellence of a telescope after dusk. She is travelling through Gemini. On the night of the 13th, she is rather more than 1° N. of ε Geminorum ("The Stars in their Seasons," Map II.) Mars, as a big red star, is visible until close upon midnight. He is in a blank part of Leo, and is travelling towards Regulus (Zodiacal Map, p. 70). Jupiter is getting very rapidly towards the West, and must be looked at the moment it is sufficiently dark. His position in Cancer may be seen in the Zodiacal Map on p. 40. The visible phenomena of his satellites occurring before 1 a.m. during the next fortnight are these:—To-night (the 9th) the egress of the shadow of Satellite III. will happen at 9h. 59m.; the transit of Satellite I. begins at 10h. 26m.; and its shadow follows it on to Jupiter at 11h. 38m. p.m. On the 10th, Satellite IV. will disappear in eclipse at 10h. 2m. 25s.; and Satellite I. reappear from eclipse at 11h. 9m. 21s. p.m. On the 16th, Satellite III. will leave Jupiter's disc at 9h. 16m. The passage of this satellite across and off the face of the planet should be carefully watched for any abnormal appearances. Later, Satellite II. will be occulted at 10h. 11m., and the shadow of Satellite III. enters on to Jupiter's limb at 10h. 18m., an hour and two minutes after the satellite casting it has quitted the opposite one. On the 17th, Satellite I. will be occulted at 9h. 38m. p.m. On the 18th, the egress of Satellite I. after transit will happen at 9h. 14m. The shadow of Satellite II. will pass off at 9h. 57m. (the *colour* of this should be noted), and the egress of the shadow of Satellite I. will happen at 10h. 22m. p.m. Lastly, on the 23rd, Satellite III. will enter on to the planet's face at 9h. 55m. p.m. As in the case of the transit of this Satellite on the 16th, the student is again counselled to watch this phenomenon carefully. Saturn has left us until the autumn or winter. Uranus may still be found a little to the west and north of β Virginis ("The Stars in their Seasons," Map V.). Neptune continues to be invisible; coming, as he does, into conjunction with the Sun during the early morning of the 11th. The Moon's age at noon to-day is 13·9 days; and quite obviously 27·9 days at the same hour on the 23rd. Three occultations of fixed stars will occur during the next fortnight. The first one will happen to-night (the 9th); it is that of 6th mag. Star ν^1 Libræ, which will disappear at the Moon's dark limb at 9h. 16m. p.m., at an angle of 350° from the vertex, and reappear at her bright limb at 291° from her vertex, at 9h. 57m. On the 13th, another 6th mag. Star, B.A.C. 6292, will disappear at the bright limb of the Moon, at 11h. 54m. p.m. at an angle from her vertex of 117°; to reappear at her dark limb 40 minutes after midnight, at a vertical angle of 196°. Lastly, ρ^1 Sagittarii, a star of the 4th magnitude, will disappear at the Moon's bright limb at 11h. 35m. in the night of the 14th, at a vertical angle of 33°. It will reappear at her dark limb at 12h. 39m. p.m. at an angle of 275° from her vertex. The Moon is in Libra all day to-day and until midnight to-morrow, when she leaves that constellation to enter the narrow northern strip of Scorpio. This she takes 12 hours, as nearly as possible, to cross, and emerges in Ophiuchus at noon on the 11th. Her passage through this and a little corner of Serpens occupies until 10 a.m. on the 13th, at which hour she enters Sagittarius. It is 11 p.m. on the 15th before she quits Sagittarius for Capricornus, out of which latter constellation she moves at 5 p.m. on the 16th into Aquarius. She does not cross the boundary between this and Pisces until noon on the 19th, and her journey through this great constellation is not completed until the same hour on the 22nd. She then enters Aries, where we leave her.

"Excelsior" (letter 1213, p. 314) surely does not call the mention of Venus in the "Elements of Occultations" on p. 408 of the "Nautical Almanac" a prediction that it would be visible in the United Kingdom! The delay in the appearance of the article on Mercury in a Three-inch Telescope has arisen from the condition of the sky having precluded the possibility of making an accurate sketch of the planet at a suitable altitude. We might, of course, have copied out an account of Mercury from some work on descriptive astronomy, but we must reiterate here that every single object mentioned in the series of papers to which "Excelsior" refers has been specially seen, drawn, and described for them at the telescope itself.

XUM

"Let Knowledge grow from more to more."—ALFRED TENNYSON.

Only a small proportion of Letters received can possibly be inserted. Correspondents must not be offended, therefore, should their letters not appear.

All Editorial communications should be addressed to the EDITOR OF KNOWLEDGE; *all Business communications to the* PUBLISHERS, *at the Office, 74, Great Queen-street, W.C.* IF THIS IS NOT ATTENDED TO DELAYS ARISE FOR WHICH THE EDITOR IS NOT RESPONSIBLE.

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The Editor is not responsible for the opinions of correspondents.

NO COMMUNICATIONS ARE ANSWERED BY POST, EVEN THOUGH STAMPED AND DIRECTED ENVELOPE BE ENCLOSED.

AN ODD COINCIDENCE.

[1223]—As you are discussing coincidences and superstitions, I will mention an odd one which happened to me not long ago.

I looked into a book in which occurred the statement that the Duke of Orleans, son of Louis Philippe, gave some flowers to his wife upon the morning of his fatal accident. These flowers, it was said, were of a kind (I forget what) regarded in France as appropriate to widows. The gift, therefore, seemed ominous of the coming catastrophe.

Having read this, which, I will add, is quite out of my usual line of reading, I went to the London Library and took up, by mere accident, a book upon botany which was lying upon the table. I never look at botanical books as a rule, but I opened this, and opened it upon the statement that the flowers mentioned in the anecdote were regarded in France as appropriate to widows.

The odd coincidence that I should come upon this statement twice in one morning, though neither a botanist nor a reader of French memoirs, was as curious as the coincidence of the Duke's giving the ominous flowers on the morning of his fatal accident. The only difference was that in my case there could be no apparent meaning.

L. S.

COINCIDENCES.

[1224]—As an example of curious coincidence, the following may be worth your notice. I have recently been appointed editor of the *X.* When appointed, I found the circulation very small and "growing" smaller. A new paper had been started in the neighbouring town of B——, which was injuring our prospects in that town very seriously. In one of its issues there was a verbatim report of a lecture on spiritualism, or some subject of a like nature, the author of which dealt rather freely with "orthodox" religious views, and the result was a vigorous correspondence in the columns of my rival, which seemed to draw all attention from the *X.* in that town. I was determined to do something to divert a portion of the correspondence into the columns of the *X.* I must here say that I did not know a soul in B—— at the time, either by name or otherwise. Well, the lecturer's name was, we will say, John Jones. One morning, then, the day of publication, I was in my *sanctum*, wondering "how to do it," when this idea flashed into my mind, complete and full-grown as I present it:—

"ANSWERS TO CORRESPONDENTS."—F. O. S. (s. i. l.), B——.—We have ventured to add the three last letters in order to complete the significance of your *nom de plume*. Mr. Jones is, in our opinion, perfectly right, and the intolerance and bigotry you display is, of all intolerances, the most disagreeable and (pardon us) the most senseless.

This was, of course, intended to catch Mr. Jones's eye, and so lead him to give us a turn. It didn't have that effect, as it happened, doubtless as a punishment for my sin in committing the fraud. But now comes the coincidence. Some months after, a friend of mine, who knows B—— and most of its inhabitants well, met me, and during our conversation he said: "By-the-way, that was rather too bad of you in connection with Mr. S——." "Who's he," I asked. "Why, Fossil," he replied. "Don't know him." "Oh, everybody in B—— knows him!" he said. "But I'm not a B—— man, and know no one in B——," I said. "Well, that's curious," he remarked. "Everybody who knows F. O. S. supposes the hit was aimed at him; and, what is more singular, there had been a previous controversy between him and Mr. Jones on the very subject of the newspaper correspondence, and to cap the curiosity, he, 'F. O. S,' is regarded by everybody who knows him as a 'fossil' in matters of that kind. He ('F. O. S.') himself takes the thing as a personal affront, and won't have anything to do with the *X.* any more."

Here, then, without the slightest knowledge or clue, I had fixed on the initials of a gentleman's name. I had described his character, and had, so to speak, put my finger on a phase of it at that time more prominent than usual, viz., his hostility to Mr. Jones.

ED. OF *X.* (NOT EX-EDITOR.)

P.S.—You must understand that I had had no communication whatever on the subject of the correspondence either from "F. O. S," or anyone else. The answer was an invention addressed to an imaginary correspondent.

APPARITIONS.

[1225]—Mr. Budd's article, No. 1,181, in KNOWLEDGE, of April 11, in which he suggests that a separate action may possibly be carried on in each of the two hemispheres of which the human brain is composed, emboldens me to ask for space in its columns to describe what I myself have frequently fancied I experienced, but have till now thought was due to imagination only, viz., that I am conscious of using the *left* side of the brain under certain circumstances, and the *right* in others.

When studying any interesting book, or when occupied with any subject requiring much reflection, I involuntarily use the *left* hemisphere of the brain. The *right* side I would style the sympathetic one; I seem to use it chiefly when the feelings are roused to sympathy with others, when listening to the strains of fine music, taken as a whole, or when taking part in ordinary conversation; but, if the subject under discussion takes a deeper form, or if I begin to analyse in my own mind the component parts of orchestral music then the *left* side is called into play. I am thus sensible of independent action in the two hemispheres of the brain.

In my case, as far as reading is concerned, this state of things may be induced by the circumstance that the sight of my *left* eye is much longer than that of the *right* one; but of course this cannot apply to thinking out a subject.

I have never as yet made any observations in my own person on the duality of the brain as regards the recalling of past impressions. This is a point which seems much more difficult of determination.

We are not unfrequently told of certain persons who possess the power of dictating several letters, or of playing more than one game of chess at the same time. It would appear that, should such a thing really exist as the independent action of the two hemispheres of the human brain, such persons have this faculty developed in an extraordinary degree, though they may perhaps use it unconsciously.

COSMOPOLITAN.

[It seems to me very difficult to determine that the right or left side of the brain really *is* called alone into play,—very easy to be deceived. In playing more chess games than one simultaneously (I have often played two, blindfold, at once) there is no use of the two hemispheres separately: I feel sure of that.—R. P.]

A FALSE ALARM.

[1226]—In your article on "Ghosts," in this week's KNOWLEDGE, you speak of mistaken noises. I can tell you of a remarkable instance. An old gentleman I knew many years ago had taken to his bed on account of some slight indisposition, when he complained of a "singing" in his ears. His medical attendant, an old-fashioned practitioner, repeatedly bled and cupped him, but the singing still continued, until, one warm day, the window was opened, and he was instantly relieved. The "singing" for which the poor old gentleman had been copiously bled was produced by the wind rushing through a chink in the closed window.

EDGAR FLOWER.

GHOSTS AND GOBLINS.

[1227]—Forty years ago, the nurse of a family living at Lee, in Kent, named G——, was in the frequent habit of visiting our house with the children under her charge, to give them and us an opportunity of playing together, and on one occasion I remember she, with tears and alarm, informed us that Mrs. A. (aunt of her mistress, Mrs. G.) had that morning inquired of her (the nurse) what her mistress was doing at the front gate last night at 12 o'clock? She answered she was not there, she was in bed, having retired before ten o'clock; and that she (nurse) was the last up, and had fastened up the house before eleven o'clock. Mrs. A.

replied that could not be so, as she was certain she saw Mrs. G. at the front gate, looking up and down the road about that time (12 o'clock), that she saw her face quite plainly—although there was no moon—from her bedroom window, after she had put her candle out and was about to get into bed. Nurse here commenced crying and asserting that she was sure her mistress (Mrs. G.), although quite well then, would die soon, or that "something was going to happen." She shortly after left us, and the day after the next called again with the startling and melancholy intelligence that her mistress (Mrs. G.) had died suddenly that morning.

With the exception that the death may have taken place a day earlier or later, I am prepared, notwithstanding the length of time which has elapsed, to make affidavit of the truth of the facts above related (except, of course, those in the nurse's statement) as I was present on both occasions of the nurse's visit. T. E. W.

"TWINKLE, TWINKLE, LITTLE STAR."

[1228]—If Mr. J. W. Howell will refer to *Notes and Queries* (6th S., III., 177), he will find it stated that the original Latin version is to be found in *Arundines Cami*, written by the late Dr. Henry Drury, and it runs thus:—

"Mira, mira parva stella,
Miror quœnam sis tam bella;
Splendens eminus in illo
Alba velut gemma cœlo."

And further, that Dr. Drury attributed the English verses to the "Ryght Pithy Pleasaunt and Merie Comedie intytuled Gammer Gurton's Nedle" [*sic*, "Neele is the word.—R. P.]. Now "Gammer Gurton's Nedle" was published, I think, as early as 1574, and, therefore, it would not be quite accurate to say that the sisters Jane and Ann Taylor "first gave to the world this graceful little poem," although they may have published a version of it "fifty-five years after the death of the pious Dr. Watts." G. G. H.

INFINITY.

TRANSFORMATION OF AN OLD POEM.

"Can the millionth part of an inconceivably minute atom, or a million worlds, be logically termed small or great when we enter upon the consideration of infinity?"

[1229]—Take every man and beast that ever lived, and thereon reckon every single hair; these multiply by *each* atomic mote ever displaced by earth's rotatory sphere. Should these be known, take many millions more as grains of sand on every ocean shore. What! these are told! As many add thereto, as blades of grass that ever on earth grew. Infinituple: still you're far behind as forest leaves e'er shaken by the wind: for many millions more are on the march as starry lamps that gild the spangled arch; and these transpired, as many myriads more as units in the myriads told before, and when all these* are pondered o'er in vain and multiplied by myriads yet again, could we as *finite* beings *then* suppose that vast infinity was near her close, we might *still* persevere—but thought is vain! Infinity's not yet *commenced* her reign! MOLECULE.

SUNSET GLOWS.—SPECTRUM OF THE GLOW.—PON'S COMET.—EARTH TREMORS.

[1230]—We, in this remote corner of the world, are almost precluded from taking part in the discussions that may be going on in European circles, from the fact that by the time accounts of such discussions reach us, and anything we may have to say upon it can return, the subject itself is generally stale. Unfortunately the December number of KNOWLEDGE reached me more than usually late.

The first article in that number was on a subject in which I am particularly interested, namely, the sunset glows. Perhaps, from the fact that I have been not a mere casual observer, but a careful student of the phenomena in question, I may be excused if I offer a few remarks upon the subject. I have discussed pretty freely, from time to time, in our local press, various theories that have been put forward, to my mind more or less absurd and unreasonable. I was, however, at first, rather favourably impressed by Mr. Ranyard's theory in the article referred to; but, on thinking it over, a difficulty presented itself to my mind in connection therewith, to which I feel somewhat diffident in giving expression, from a suspicion that, if real, it must have been obvious to those able scientists in England who have discussed the question. It is this—the idea of a cloud of meteoric dust lying, as it were, asleep in the earth's pathway, is of course absurd, and the thing impossible.

Such a body must be moving, and that with planetary or cometary velocity, and in a planetary or cometary orbit. Now, in whatever direction its pathway cuts that of the earth (unless the two orbits are nearly coincident), the velocity of the collision, both bodies moving at a rate exceeding a million miles a day, would produce such a display of celestial fireworks as the world has never seen, at least since it became habitable; and the result would be the destruction of everything sublunary. I cannot, for my part, see how such a conclusion can be evaded, except by supposing both bodies to be moving in nearly coincident orbits, and, of course, in the same direction. But, then, the phenomenon would have been an old and familiar acquaintance, which it certainly is not. I admit that there are some, at least, apparent difficulties in the way of the volcanic-dust theory; but, to my mind, they are of less weight than those attaching to any other theory that I have met with. Adverting to the subject of *dust deposit*, collected from snow-water in Europe, I may mention that I observed, during our January rains, that the rain-water collected in the rain-gauge had a milk-and-watery appearance, as if whiting had been stirred in it. I have carefully preserved the whole of the month's deposit, but have not yet had time to analyse it.

Observing the glow with the spectroscope, I have noticed that it gives a very strong broad band about midway between C and D; its position by Roscoe's frontispiece scale being, as nearly as I can measure it, at 41·5. The band is, I should think, three or four times as broad and deep as the D line. There is also another very broad band on the edge of the yellow, just between the yellow and the green, shading off into the green. I must leave this to others to interpret, as I cannot.

I obtained spectroscopic observations of Comet Pons between Jan. 26 and Feb. 3. I noticed three broadish light lines. These were pretty sharp and decided on the side next the red, but shaded off towards the violet. The spaces between were perfectly dark, although I cannot say that I might not have obtained a continuous spectrum had I been able to grasp more of the comet's light. My telescope is only a three-inch refractor. By means of a "ghost" scale of my own contrivance, specially designed for double star work, I got as accurate a measure as I could of the position of these lines, as follows, reduced to Roscoe's scale: 59·3, 72·2, and 99·5, the D line being at 50. By means of the reflecting prism, I projected the spectrum of common gas flame, turned down to a minute blue point, into juxtaposition with that of the comet, when I found the lines of the two spectra to coincide perfectly, so far as the comet lines were concerned.

We have been experiencing during the last nine months a sensation of which the novelty is beginning to wear off—namely, a continuous succession of minute earth-tremors, sometimes several in a day, very few days passing without them. A. B. BIGGS.

Launceston, Tasmania, March 16.

POTATOES AND FRUIT-TREES IN IRELAND.

[1231]—As the writer of No. 1,218 denies that the poor Irish cottiers are a potato-fed people, and No. 1,219 denies that rack-renting has prevailed in Ireland, it is pretty evident that I am invited to a Donnybrook; but KNOWLEDGE not being a fit arena for a prolonged Irish debate on the Land Question I must decline to tread on the coat-tails so alluringly trailed before me. I may, however, state that I hope to make the further visit suggested by Mr. Milligan as soon as the security of tenure and fair rents enforced by the Land Act have had time to effect the changes which I anticipate as the necessary consequences of securing to the tiller of the soil the fruits of his own industry. Then I may hope to verify his account of the potato being used only as a vegetable supplement to the peasant's dinner, instead of being what I found it during the summers of 1876, 1877, and 1878. When I next have supper, bed, and breakfast in the hut of a worthy and intelligent Irish farmer I hope to find some of the appetising cakes described by Mr. Milligan, "served up hot with plenty of butter" instead of seeing the contents of a cauldron of potatoes turned out on a cloth without dishes, plates, knives, forks, or spoons, and the father, mother, sons, daughters, and self picking them up in our fingers, casting aside their skins, and dipping them into the little pile of salt, which was the only addition to the meal. I hope to find that such will no longer be the daily fare of the honest, gentle, industrious, and intelligent people with whom I have shared it.

In return to Mr. Milligan's desire that I shall thus revisit Ireland, I recommend him during the coming summer to visit *Keel* and *Keem*, on the Island of Achill, and other villages in the midst of the glorious scenery of the west coast of Mayo, Galway, and Donegal. If he would learn something concerning the true condition of his own fellow-countrymen, he must not, when there, merely lodge at the hotels, but try the sheebeens and clay-floored cottages. To see these thoroughly, let him make acquaintance with the

* Miles, years, or worlds, as it may suit the reader's mood in his determination of "Infinity" of distance, time, or bulk, in increasing or diminishing ratio.

parish priest, and ask him to act as mentor in visiting these interiors; he will thus learn a good deal concerning Ireland of which resident Irishmen of Dublin and other cities are curiously ignorant. W. MATTIEU WILLIAMS.

VEGETABLE FOOD AND FLESH FOOD.

[1232]—I am sorry not to have seen J. Bindon Carter's letter before this, but many engagements have prevented me reading KNOWLEDGE as issued. I may reply that I am a believer in a non-flesh diet on scientific principles, for all my studies so far seem to indicate that such a diet is most suited for man. If I could prove to my own satisfaction that a mixture of flesh and vegetables was more beneficial than the use of a non-flesh diet, then I would at once adopt it, cruelty to animals notwithstanding. But my own experience of over two years, my knowledge of scores of vegetarians, and the testimonies of hundreds of others, all point to the benefit of a non-flesh diet—at least in their cases.

The question of the nutritive values of various foods is very important, and can only be arrived at by experiment. The amount of carbon, nitrogen, &c., a food contains is one thing, the amount the system extracts is another. Experiment seems to show that we never get all the possible nourishment from our food; the length of man's intestine points to a diet in which the nourishment should not be too concentrated. Bulk is a necessity, for it allows of more proper filling up of the intestinal canal; innutritious particles are also necessary, as they allow the gastric and intestinal juices to penetrate more, and also by their presence give rise to daily laxation. Foods which are too rich in nourishment flood the system with material which it has to get rid of, so that by eating a certain quantity of bulky but little nourishing food daily, we tend to keep ourselves in good condition.

A table, showing the chemical composition of food alone is fallacious, and should be verified by actual experiment. Some foods reckoned low in the nutritive scale are found high in the experimental, and *vice-versâ*.

Weight is no criterion to go by, except between certain limits, to exceed or be below which is unhealthy. The diseases of the digestive and excretive organs are all intensified by the use of flesh. Believing as I do in man's evolution, he must be subject to a certain amount of disease, but I think that the disease a man should suffer from should be rather hereditary than acquired, and that with care and an average constitution a man ought never to have any serious illness, *i.e.*, if he lives according to the physiology of his being. The special diseases of vegetarians I have not as yet been able to discover, but it is possible that time and experience may point some out. The vegetarian inhabitants of a country—all things being equal—seem to be superior to those who are mixed feeders. They are taller in stature, more healthful, more cheerful and longer lived, such at least is my experience from observation and reading.

As to the query, if a person may not feel better when he is told that he is looking better, or expects that he should be better, it is a fact that such is the case, as all hypochondriacs relate when put under new treatment. With the editor's permission, I will give next week a table of dietaries showing the value of some foods as shown by experiment. As they are almost unknown they may be of great value to future inquirers and experimenters.

T. R. ALLINSON, L.R.C.P.

A STRANGE INCIDENT.

[1233]—I send you the following facts. On April 23, at 5 p.m., I was trimming my grape-vine in one of my hot-houses, when suddenly a stone, about 1 oz. 13 dwts., came through the largest pane in the house, fell with some considerable force on the brick floor, and split in two pieces. I picked it up, and it burnt my hand most severely before I could leave go of it. I have the stone, which looks a very common one (in two pieces), and if you wish, I will forward it to you.

The hot-houses are 380 yards from the road, and the urchins here seem unacquainted with the sling. I have made inquiries, and no one ever saw an Essex boy with a sling. No one that I know of would have cast a stone on to the hot-house, but, of course, such a hypothesis is possible. The only thing against this is, the stone was red-hot, and burnt my fingers very much. It measures about 3 in. round, and inside appears to be quartz or feltspar, which looks as if it had been exposed to intense heat.

If you feel any interest in this, to me, rather curious incident, I will send you the stone. J. T. NORGATE, General.

[The case seems to me very singular. The stone should be sent to one who has made the structure of meteorites a special study. —R. P.]

CYCLISTS AND FOOT PASSENGERS [ON THE CARRIAGE-WAY].

[1234]—The ignorance and stupidity which foot passengers show in relation with cyclists seem invincible. I was particularly distressed to read in KNOWLEDGE of this week an account by Mr. Browning of the annoyance to which so eminent and responsible a person (in a cycling sense) as himself was subjected by two ladies. They were it seems, quietly walking along the high road, and no doubt, in their own opinion, harmlessly enjoying a common right, and safe in trusting to the most elementary observance of law and courtesy on the part of their fellow-subjects. Alas for their ignorance! They were, in fact, grossly *in delicto*. Firstly, they were in the line which Mr. Browning and his companion, Mr. Cooper, had been pleased to choose for their progress on a tricycle. Only a few eccentrics would care to defend such conduct, for it cannot be too emphatically stated that the purpose of a steering mechanism (in this case the steering of the machine "was marvellous," and could be managed "with perfect certainty within an inch") is solely to avoid objects dangerous to the rider. Secondly, the ladies were somewhat deaf, and failed to hear the bell, which was condescendingly tinkled for their warning. This fault, though sufficiently irritating, did not exhaust the forbearance of the gallant tricyclists; it seems, however, fortunately for the ladies, to have evoked from Mr. Cooper a mode of expressing his feelings probably quite natural and proper to his disposition. He gave vent to a savage yell. Thus were the ladies saved. But pedestrians must not expect to find the same kind patience in all tricyclists. In the paper this morning it is stated that at Southport a man was fined £1. 4s. for running over a child. This is clearly a misprint. It was the father of the child, no doubt, who was fined for allowing his brat to get in the way.—Yours, &c., VERBUM SAP.

[The principle which our humorous correspondent supports is sound enough. The tricyclist should doubtless show courtesy and consideration to his fellow-passengers. But "Verbum Sap" overlooks the facts of the case. If the ladies really were deaf, it was surely unwise on their part to walk in the part of the roadway intended for vehicles, without frequently looking back to see that no vehicles were coming. Apart from any deafness a foot-passenger who uses the carriage-way ought to keep from the mid-track. Supposing any one, man woman or child, deaf or otherwise, chooses to walk in a part of the roadway not intended for foot-passengers, there is no course for the driver of a vehicle overtaking such an obstructionist but to signal his approach in such a way as to be heard. If, instead, he changes his course at the moment of close approach or even earlier, there is always the risk that the foolish person will at the last moment jump out of the mid-track into the course taken to avoid overrunning him. I am an advocate of the most careful consideration of the rights of others, and I think I carry out the principle to an even unwise degree, for some are not always considerate, and take advantage of the consideration shown by others: but I must confess I can see no other course for Mr. Browning and his fellow-tricyclist than than which was pursued—*i.e.*, to signal with constantly increasing vehemence till attended to.—R. P.]

TRICYCLE PROBLEM.

[1235]—In watching a bicycle or tricycle wheel travelling through dust, one sees a portion of the dust following up the tyre, especially clustering round what would be the outer edge of the tyre. This dust does not complete the circle with the wheel, but is thrown off in a small jet, which, provided there was not a strong wind blowing at the time, would settle as a ridge between the sides of the rut. Mud, being heavier than dust, is thrown off with greater velocity, and as most bicyclists find, lodges on the coat, neck, and hat of the rider.

Hoping this will satisfy "O. M.,"—I am yours,

C. COLVILL, Hon. Sec. Orion B.C.

THE EARTH'S ROTUNDITY.

[1236]—With reference to your familiar illustrations of the rotundity of the earth's surface, I send you one or two easily corroborated by any intelligent observer out here. You are, perhaps, not acquainted with the vast expanses of the "plains of India," prodigious stretches of cultivation unencumbered with tree or mound. On these, when in crop or reaped, you can distictly *see* the swell of the earth's bosom, and others have seen it with me, and didn't require *the backs* of distant grazing kine to corroborate the fact. I have *often* seen the same receding swell in the Bay of Bengal from the deck of a steamer, between me and the hulls down on the horizon. Our great railways crossing over plains also

abundantly illustrate the rotundity of the earth. Take any sketch and you will see it commencing and terminating in the hazy quiver of mirage. Watch for a due train, and you will see the smoke first, then the funnel, and lastly the body of the engine. Do so at night and you will see the *apex* of the red lights' triangle first, and *then the base*.

I might enlarge on the marvellous panorama of distance which you catch, say from the Hill Station of Mussooree (6,653 ft. a. t. s.) from whence you can under favourable circumstances see Meerut, 100 miles south, but the illustrations advanced, familiar to every one, will suffice. R. F. H.

Moror, April 4, 1884.

LETTERS RECEIVED.

J. R. SUTTON.—Have not had time to read your long letter, manifestly wrathful and absurd. I supposed your communication meant for a letter. You are quite mistaken in supposing that letters of that length are not sent in that form or with stamped envelope for return if not used. It is the commonest thing in the world. I thought you had taken a great deal of trouble over it, and that your ideas (which are in fact much the same as I have myself expressed in lecturing on the moon) were sound enough. Therefore, though the communication was incomplete, I inserted it among the letters, with the idea that the writer (obviously a beginner) would be well pleased. I regret that what I regarded as a favour was taken as an offence; and—well, that is about the end of the matter.—J. HARTLETON, NEBRASKA. You have not rightly understood me. Professor Ruskin has done such excellent service to art, he has shown himself so great a master of language, that one cares ill to speak of him in other terms save such as imply esteem and respect. He represents a school of thought moreover which even those who do not greatly sympathise with its teachings must regard with interest. Men who look backward through the blue haze of the past and see a beauty in the remote which had not been felt (if we can judge from what they say of it) by those who saw it close at hand interest us, as a Turner interests us by showing beauties in a haze-wrapt landscape which less poetic vision had failed to realise. If a Turner or a Ruskin however claims to see more through a haze than through a clear air, or more through what we call clear air in England than through the purer air of Italy or America, we cannot but protest against the mistake even if we be not tempted to regard it as a pretence. Such, however, is what Professor Ruskin claimed to do in the lecture at the London Institution on which I commented. He spoke with contempt of scientific researches as showing nothing worth seeing, while artistic vision sees, he said, all that is worth knowing. So utter was the scorn, indeed, with which he denounced the teachings of science, that a tone of similar warmth might seem not unfair if imparted to comments on his own teachings (where at least he left his own domain). But science ought at least to have learned the lesson that in the search for truth which should be the work of science, warmth and scorn and rancour are out of place. Let us rather see whether there is any element of truth in what Professor Ruskin actually found to say against "the scientific people." His subject was a kind of storm-cloud which he regards as new, and claims to have discovered,—a storm cloud or more accurately a plague cloud. Before 1871 the various forms of cloud were healthy and wholesome. Professor Ruskin classifies them rather oddly. He recognises two sorts of clouds, one either stationary or slow in motion, the other fast-flying; the former reflecting unresolved light, the other transmitting resolved light. He has "a suspicion that the prismatic cloud is of finely comminuted water or ice, instead of aqueous vapour." The other cloud therefore he regards (we may safely assume) as *consisting* of aqueous vapour! For he laughs to scorn the scientific notion that aqueous vapour is no more discernible in the air than oxygen or nitrogen. "Not so. With cloud vapour, it is as with most other things, that are seen when they are there and not seen when they are not there, nor has cloud vapour so much of the ghost in it that it can be visible or invisible when it likes, and might perhaps be all unpleasantly and malignantly there just as much when we do not see it as when we do." (We must really not allow "the scientific people" to say that rain or water or cloud vapour can be palpable in one place and impalpable somewhere else, visible here but invisible there. It would be as unreasonable almost as to say that water could be soft under one set of conditions and hard under another). But outside this classification lies another sort of cloud. Consisting neither of comminuted water or ice, nor of cloud vapour, the storm cloud or plague cloud is formed of devil's dust and chimney vomit. With a thickness of perhaps five miles the plague wind chokes the sun out of the whole heaven all day long. But this "thin, scraggy, mangy, miserable cloud, for all the depth of it, could not turn the sun red as a good business-like fog does with a hundred feet or so of itself." This wind in other respects behaves very ill. It blows tremulously, hissing instead of wailing as a respectable wind should, and it simulates that sound so familiar to us all, the tone of a flute made of a file. Moreover, "it pollutes and intensifies the violence of all natural and necessary storms." These are the facts; the meaning Prof. Ruskin suggests is what men would have suggested in the good old days before Magnus and Tyndall and J. W. Draper confused counsel by physical and chemical investigations. It is for our sins we have this wind of darkness, this mangy, miserable, malignant cloud. When we bring back honesty and cheerfulness, cease to trouble our own passions, and watch against the insolence of our own lips, we may again have clear skies or skies only flecked by the fleecy clouds of summer or the darker but transient rain-clouds of former times. Surely the student of science is justified in smiling at all this as sheer windy nonsense.—ONE TAKEN IN BUT STILL HAPPY. I know and have said nothing whatever about the originality of the system; but I suspect that could it so easily be shown to be borrowed as you say, we should have seen this proved long ago.—THOS. S. WILKINS. I fully agree with you as to the great value of F.R.A.S.'s "Nights" (may his days be long). I hope he may be able to arrange for the publication of these and the "Moon Papers" as separate volumes.—J. E. GORE and SENEX. Thanks. Corrected.—H. ASKEW. Thanks.—B. J. HOPKINS. I think letter is in type.—J. B. WILLIAMS. Thanks. Letter shall appear.—KENGE. Your early solution of Mr. Lewis's problem was as you say quite correct. The absence of "Five of Clubs" led to some letters being mislaid.—EL. C. PEARCE. The lecture will be delivered at Richmond (Surrey) some time in June. Nowhere else near London before autumn.—C. H. P. Thanks; will use your odd coincidence if I can find space.—J. W. Streams of cold air coming in through the moisture-laden air within the tent would cause condensation. Had the entering air been cold enough, small snowflakes would have been formed,—a phenomenon which has been frequently observed.—BAUERNSOHN. The writer of the "How to get Strong" papers not being a medical man would not care to advise. But I may mention from my own experience that such swellings are commonly enough noticed after hard rowing. I have been lamed for a week by them in old racing days. But they did me no permanent injury.—A. VON. Y—Z. Fear some readers would not appreciate your idea, in which doubtless there is a germ of truth.—T. H. So many valued friends,—all my *most* valued friends,—are examples to the contrary, that I remain unconvinced. I will not dwell on the fact that I personally object intensely to much that is contained in the treatise you so much admire. The utter immorality of the conduct pursued, (according to the opening pages of the first section) by the leading character in the romance, is *par-trop fort*, though on a par with the principles or utter absence of principle attributed to him later on. That he improves immensely towards the end, I am ready to admit. But one cannot forget his earlier ways. On the whole, the work is not at all to my mind,—so strangely do tastes differ!—J. MACANDREW. Men form their own idea, mostly, of the nature of Deity, each evolving his conceptions from his own inner nature. From what you tell me you think on the subject, I am obliged to infer that you are by nature cold, hard, cruel, and unforgiving. You select descriptions of deity which correspond with your own nature, and overlook those which gentler minds and more long-suffering natures have suggested. Streams cannot rise above their source, nor even "meander" (as that wonderful poet (?) Mr. Robert Montgomery tried to make them) "level with their fount." The God of the unjust is an unjust God; the God of the oriental slave is an oriental despot. I would rather hearken to those who picture Deity as just and merciful. May I venture to make a new proverb for your benefit,—Show me a man's God and I will show you the man.—LLANGOLLEN. I am not myself a Welshman, though in considerable degree of Welsh blood. But I am told that the proper way of pronouncing "ll" in Wales is conveyed in the following formula addressed to a Bishop. "May it please your right reverend lordship to place your episcopal tongue lightly against your right reverend teeth, and hiss like a goose."—J. R. WILLIAMS. "Give it up."—EXCELSIOR. Thanks for suggestions. But you are quite mistaken about the zodiacal signs. At the vernal equinox, the earth's heliocentric position is at the first point of Libra,—the sun's geocentric position being, of course, at the point of Aries.—I. J. COLLINS. Your interesting case of coincidence shall certainly appear.—W. H. FRANCE. Many thanks; will insert if can get space.—G. H. WILKINSON. We must make allowances for a daughter defending her father's memory.—E. A. M. Thanks; many readers seemed to think we had dealt already too fully with the subject.—H. JONES. "Five of Clubs" does not play Nap; nor do I.—B. M., F.R.C.S. Article on "Ghosts" is *not* "intended altogether to demolish the existence of those occurrences as supernatural facts."

XUM

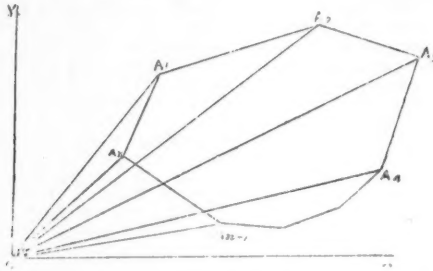
Our Mathematical Column.

EASY LESSONS IN CO-ORDINATE GEOMETRY.

BY RICHARD A. PROCTOR.

(*Continued from page* 298.)

17. *To express the area of a polygon in terms of the co-ordinates of its angular points.*



Let $A_1, A_2, A_3, A_4 \ldots A_{n-1}, A_n$ be the angular points of a polygon, and let the co-ordinates of these points be respectively $x_1y_1, x_2y_2, x_3y_3, \ldots x_{n-1}y_{n-1}, x_ny_n$; then the area of the polygon.

$$= \Delta OA_1A_2 + \Delta OA_2A_3 + \ldots - \Delta OA_{n-1}A_n - \Delta OA_nA_1$$

$$= \frac{1}{2}\{x_2y_1 - x_1y_2 + x_3y_2 - x_2y_3 + \ldots + x_ny_{n-1} - x_{n-1}y_n + x_1y_n - x_ny_1\}$$

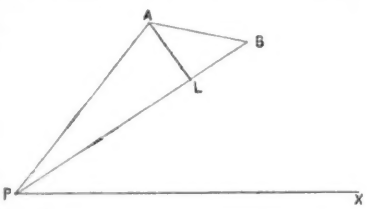
which may be written in either of the forms

$$\frac{1}{2}\{x_1(y_n - y_2) + x_2(y_1 - y_3) + x_3(y_2 - y_4) + \ldots + x_n(y_{n-1} - y_1)\}$$

or $$\frac{1}{2}\{y_1(x_2 - x_n) + y_2(x_3 - x_1) + y_3(x_4 - x_2) + \ldots + y_n(x_1 - x_{n-1})\}$$

We have supposed in 14, 15, 16, and 17 that the axes are rectangular; if the axes are oblique, and ω is the angle of ordination, it is evident the expression obtained in Article 14 must be multiplied by $\sin\omega$, to give the correct area. Hence all the expressions obtained in 15, 16, and 17 must be multiplied by $\sin\omega$, when the axes are oblique.

18. *To determine the area of the triangle* P A B, *one of whose angles is at the pole, in terms of the polar co-ordinates of the other angular points.*



Let the co-ordinates of A be r_1, θ_1; those of B, r_2, θ_2. Draw A L square to P B. Then

$$\text{Area A P B} = \tfrac{1}{2}\text{A L} \cdot \text{P B}$$

$$= \tfrac{1}{2}r_1r_2\sin(\theta_1 - \theta_2)$$

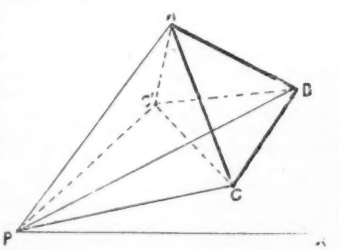
This expression always represents the area correctly in quantity, but is positive or negative according as $\theta_1 >$ or $< \theta_2$.

SCHOL. Writing the expression just obtained

$$\tfrac{1}{2}(r_1\sin\theta_1\, r_2\cos\theta_2 - r_2\sin\theta_2\, r_1\cos\theta_1)$$

we see that it might have been obtained from the expression in rectangular co-ordinates, or conversely that expression might have been obtained from the expression in polar co-ordinates.

19. *To determine the area of a triangle* A B C, *in terms of its polar co-ordinates.*



Let the co-ordinates of the points A, B, C, be respectively r_1, θ_1; r_2, θ_2; r_3, θ_3. Then

$$\Delta ABC = \Delta AOB + \Delta BOC - \Delta AOC$$

$$= \frac{1}{2}\{r_1r_2\sin(\theta_1 - \theta_2) + r_2r_3\sin(\theta_2 - \theta_3) + r_3r_1\sin(\theta_3 - \theta_1)\}$$

This is always the proper quantitative expression for the area. It might have been obtained from the expression in rectangular co-ordinates, and conversely the latter expression might have been obtained from the above. The condition for the expression to be positive is sufficiently obvious,—as is also the change which has to be made if the third angle falls as at C′ instead of as at C.

I have included 19 among the examples which follow, and a further proposition which the reader will find no difficulty in solving relating to the expression for the area of a polygon in terms of the polar co-ordinates of its angular points.

EXAMPLES.

(1) Indicate in a figure the points whose rectilinear co-ordinates are

(i) $x=2, y=3$; (ii) $x=3, y=2$;
(iii) $x=-2, y=3$; (iv) $x=3, y=-2$;
(v) $x=2, y=-3$; (vi) $x=-3, y=2$;
(vii) $x=-2, y=-3$; (vii) $x=-3, y=-2$;

first, when the axes are rectangular; secondly, when the axes are oblique and the angle of ordination = 60°.

(2) Indicate in a figure the points whose polar co-ordinates are

(i) $r=2, \theta=\frac{\pi}{6}$; (ii) $r=-2, \theta=\frac{2\pi}{3}$;

(iii) $r=2, \theta=-\frac{\pi}{6}$; (iv) $r=-2, \theta=\frac{4\pi}{3}$;

(3) Write down the rectilinear co-ordinates of all the points in Ex. 2; and find the polar co-ordinates of all the points in Ex. 1, the axes being supposed to be rectangular.

(4) Determine the lengths of the lines joining the following pairs of points in Ex. 1:—

(I) points (i), and (ii); (II) points (i) and (iii);
(III) points (i) and (iv); (IV) points (i) and (vi);
(V) points (i) and (vii); (VI) points (i) and (viii).

Determine also the lengths of the lines joining every pair of points in Ex. (2.)

(5) Find the co-ordinates of the middle point of the line joining the points x_1y_1, x_2y_2.

(6) The co-ordinates of the angular points of a triangle are x_1y_1, x_2y_2, and x_3y_3. A straight line is drawn from any one of the angular points to the bisection of the opposite side, and trisected. Find the co-ordinates of the point of trisection remote from the angular point.

Hence show that the three lines drawn from the angular points to the bisections of the opposite sides pass through one point.

(7) There are four points whose co-ordinates are x_1y_1, x_2y_2, x_3y_3, and x_4y_4. Any two of these points are joined, and also the remaining two, and the lines thus drawn are bisected. Find the co-ordinates of the point of bisection of the line joining the two points thus obtained.

Hence show that the lines joining the bisections of opposite sides of a quadrilateral, and the line joining the bisections of the diagonals, pass through one point, and are all bisected in that point.

(8) Show that the area of the triangle the co-ordinates of whose angular points are $(a-b)$, $(a+b)$; $(b-c)$, $(b+c)$; and $(c-a)$, $(c+a)$, is

$$= ab + bc + ca - a^2 - b^2 - c^2$$

(9) Show that the area of a triangle the polar co-ordinates of whose angular points are (r_1, θ_1), (r_2, θ_2), and (r_3, θ_3), is

$$\pm\frac{1}{2}\{r_1r_2\sin(\theta_1 - \theta_2) + r_2r_3\sin(\theta_2 - \theta_3) + r_3r_1\sin(\theta_3 - \theta_1)\}$$

(10) Show that the area of a polygon the polar co-ordinates of whose angular points taken in order round the polygon are (r_1, θ_1), (r_2, θ_2), (r_3, θ_3), (r_4, θ_4), $\ldots\ldots$ (r_{n-1}, θ_{n-1}) and (r_n, θ_n) is

$$\pm\frac{1}{2}\{r_1r_2\sin(\theta_1 - \theta_2) + r_2r_3\sin(\theta_2 - \theta_3) + r_3r_4\sin(\theta_3 - \theta_4) + \ldots$$

$$\ldots\ldots + r_{n-1}r_n\sin(\theta_{n-1} - \theta_n) + r_nr_1\sin(\theta_n - \theta_1)\}$$

THE production of coal in the United Kingdom in 1883 was 163,737,327 tons, against a total output of 156,499,977 tons in the preceding year. This is an increase of 7,237,350 tons, or 4·6 per cent., on the production of 1882. To this increase the chief contributors were:—Glamorganshire, with an advance of 1,315,487 tons; Yorkshire, with an advance of 1,037,399 tons; Scotland, with an advance of 710,633 tons; Lancashire, with an advance of 704,672 tons; Monmouth, with an advance of 623,542 tons. The total production of coal in 1882 exceeded by 2,315,677 tons the output of 1881, and by 9,530,568 tons the output of 1880. Within the last three years, therefore, the production of coal in the United Kingdom has increased to the extent of 16,767,918 tons. Mr. J. S. Jeans, secretary of the British Iron Trade Association, remarks:—"It is not without interest to note that this amount of increase is within 4,000,000 tons of the whole coal output of France, is approximately the same as that of Belgium, and is more than equal to the whole annual production of the United Kingdom previous to 1810.

Our Chess Column.

EASY NOTES ON THE CHESS OPENINGS.

By RICHARD A. PROCTOR.

OUR Chess Editor "Mephisto" keeps his eye, at my especial request, on this part of our Chess matter. He has played, I suppose, five hundred games at least, for every game I have played, and is a Chess genius besides; so that he can at once mark any weak point in my remarks on the various openings. Thus, dealing with the line 1. P to K4 / P to K4 2. Kt to KB3 / P to Q3 3. P to Q4 / P takes P 4. Kt takes P. I remarked (in my original MS.) that in response to 4. Q to KR5 a move of my own devising, White's best play seems to be 5. Q to Q3. "Mephisto" substitued 5. Kt to QB3 as probably a better move. His objection to my suggested fifth move for White is probably that Q at Q3 is in the path of the KB. I should like to have a note by "Mephisto" on the move 5. B to KKt5 in reply to his suggested fifth move. If White Queen now moves she hampers one or other of the Bishops; if King's Bishop interposes, Black can exchange Bishops, and equalise the positions; if KKt interposes at KB3, 6. Q to KR4 seems good for Black. However "Mephisto" may see some weak point in this move 5. B to KKt5.*

We now proceed to examine the consequences of Black declining at the third move to take the proffered Queen's Pawn. It is well known, though oddly enough Chess writers never seem to think it worth while to show it, that in the Scotch Gambit, where White at his third move pushes the Queen's Pawn to its fourth square, after Black had defended his King's Pawn with the Queen's Knight, Black gets a very bad game if he fails to take the proffered Pawn. Therefore if Black after 1. P to K4 / P to K4 2. Kt to KB3 / P to Q3 3. P to Q4 reply with 3. Kt to QB3, he has a bad game; but the discussion of its weakness may properly be left to the time when we are dealing with the Scotch Gambit. As we have already noted the best reply to White's third move, if the Pawn is not captured, is Kt to Q2. But three others are available. The position is

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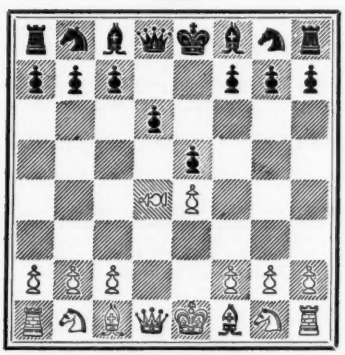

WHITE.

Position after 3. P to Q4.

I leave to the last the move which really completes Philidor's defence—viz., 3. P to KB4, considering the three following lines, one of which bifurcates:—

3.	Kt to Q2	Kt to KB3		B to KKt5
4.	B to QB4 (*a*)	Kt to QB3	P takes P (*b*)	P takes P
	Kt to Kt3	P takes P	Kt takes P	B takes Kt
5.	B to QKt3	Q takes P	B to QB4	Q takes B
	P takes P	B to K2	P to QB3	P takes P
6.	Q takes P*	B to K3	Castles	B to QB4
	B to K3	Castles	P to Q4	Q to Q2
7.	Kt to QB3	Castles (Q)	B to Q3	Q to QKt3
	Kt to K2	Kt to QB3	Kt to B4	P to QB3
8.	B to K3	Q to Q2	B to K3	P to QR4
	Kt to QB3	P to QR3	B to Kt5	B to Q3
9.	Q to Q3	B to Q3		Castles
	Kt to K4			
	Equal game.	White has the better game.	Equal game.	White has the better game.

These four lines are precisely as given in Mr. Cooke's excellent "Synopsis of the Openings," of which work (I am glad to hear it from headquarters) a new edition is now in the Press. As one of my chief objects in these simple analyses has been to bring the various openings before home Chess players as presented by the leading authorities, and Mr. Cooke's book does this effectually and very cheaply, I shall now (that I know his book is soon to be reprinted) adopt a slightly different course, showing *not* what are the various lines which may be followed in the different openings, but what lines, among those which might be followed, the student of home Chess may conveniently select for study. I shall in fact continue these papers with the object of simplifying as much as possible the study of the openings, endeavouring to correct at the outset the idea that to have a chance of success in Chess play with those who know all the openings the learner should be equally well versed in them. Just as in Whist "Five of Clubs" showed that half-a-column could be made to contain all that the learner need know about the leads (which in the "Correct Card" look like legion) so shall I here endeavour to show that a few nights' study of certain leading lines will put the home player on an equal footing, so far as book-lore is concerned, with the player who knows the approved play on every known line of opening hitherto adopted.

NOTES.

(*a*) Or White may play P to QB3, as recommended by Steinitz, a move which practically prevents the capture of the Queen's Pawn by Black.

(*b*) B to KKt5 is better, because practically it forces Black to take the Queen's Pawn, after which if White plays sound developing strategy (not retaking the Pawn at the moment), he seems to me to get the better game.

(*To be continued*).

ANSWERS TO CORRESPONDENTS.

****** *Please address Chess Editor.*

W.—Thanks for Problem, which is welcome. We shall be pleased to receive a few more such selected masterpieces.

W. SHERRARD.—Problem received with thanks. Your three-mover reached us twelve months ago, when, after examining it, did not there and then destroy it; hence its appearance.

CORRECT solution of End Game received from Clarence, W. H. L. M. (Dublin), Fui, James Rayner, S. B. B., George Robson, A. Rutherford, Wm. H. Curtis, W., A. K. Lane, A. H. S., A. Hill, Herbert F. Lowe.

PROBLEMS correctly solved by Donna, Punch, S. B. B., W., Clarence, H. Seward, John Watson, Uncle John, Edward Sargant, Fill.

CORRECTION Problem, No. 117, can be solved by 1. R to Kt3 (ch). This, however, is not the author's intended solution.

---

* In reply to B to Kt5 White plays 6. B to K2, B takes B. 7. Q takes B. A little study of this position will prove that White has the best of it. White has two pieces developed, and all his forces have great liberty of action; he may also Castle. Black has no pieces developed, his Queen will soon have to retire, and his forces are cramped. White's Kt on Q4 occupies a very strong position. If Black plays P to QB4 his Q's P would be hopelessly compromised, as White subsequently could bring Kt, B, and R to bear upon it. Besides these general disadvantages, Black is threatened with a check by Q to Kt5. If to prevent this Black plays 7. P to QR3, White again gains important time for Castling, to be followed by P to KB4, or he may play 8. Kt to Q5 at once. 7. P to QB3 would not be an improvement on P to QR3, as that would render the QP weak. In any case White obtains a superior development. I take this opportunity of drawing attention to the commanding position occupied by a Kt on Q4 if the adverse KB is blocked in. This is the case in some variations of the Scotch Gambit and the Three Knights' Game, and forms a great objection to this opening.—MEPHISTO.

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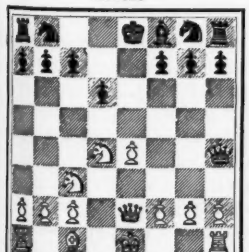


WHITE.

A CORRESPONDENT asks if, after 1. P to K4, P to K4; 2. Kt to KB3, P to Q3; 3. P to Q4, P takes P; 4. B to B4, Black could not now play B to Kt. 5. There is nothing to prevent him doing so. White might continue with 5. P to B3, threatening to play Q to Kt3.—MEPHISTO.

* I prefer 6. Kt takes P.—MEPHISTO.

Our Whist Column.

By Five of Clubs.

ILLUSTRATIVE GAME.

THE following game from the *Westminster Papers* illustrates Whist Malignity. We believe, but are not sure, that our correspondent Pembridge, the esteemed author of "Bumblepuppy," was the unhappy *A*.

The Hands.

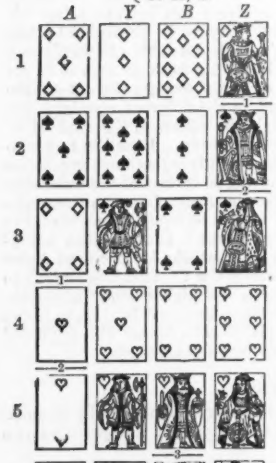
B { *D.* Kn, 10. / *C.* Q, 8, 3. } S. 10, 9, 4, 3. / H. K, 8, 7, 4.

Y { *D.* 3. / S. Kn, 8. / H. Kn, 5 [6, 5, 4. / C. K, Kn, 10, 9, 7. }

A-B, 0. **B** *Tr.* DQ. **Y** *Y-Z, 2.* **Z** 2]. **A** Leads.

Z { 2, 8, 9, Q, K. *D.* / 6, 7, Q, K, A. S. / 6, Q. H. / None. C. }

A { *D.* A, 7, 6, 5, 4. / *C.* A, 2. } S. 5. / H. A, 10, 9, 3, 2.



NOTES AND INFERENCES.

1. *A* properly leads trumps from Five; and in trumps it is better to lead the penultimate than the Ace. *Z* plays the King, because the Queen was turned up.

3. *B* now knows that all the remaining Spades except the two he holds, or four Spades, are with *Z*. Let us see what use he will presently make of this knowledge.

4. Having been forced, *A* does not go on with trumps. He leads Ace from his five-card plain suit.

6. *B* leads trumps (though his partner has discontinued) because of the Queen turned up. In this *B* was right, as there is good reason for expecting that after this second round *A* would draw two trumps for one. But *Y* failing to follow suit shows *B*'s lead to have been unfortunate.

8. *B* sees that *Z* means to draw out *A*'s last trump, and to bring in Spades, which make up the rest of *Z*'s hand. But he himself holds second and third best. So he holds the command in the suit, and has nothing to do but to discard two small Clubs, suffer his Spade Nine to fall to *Z*'s Ace, and then, winning the next trick in Spades, bring in his partner's Hearts. Wherever Club Ace and King may be, this course is absolutely sure, and three tricks must thus be made. But *B* craftily seizes on the only possible course by which every remaining trick can be made over to *Y-Z*.

9, 10, 11, 12, 13. *B*'s triumph and *A*'s discomfiture.

To "Pembridge" whose interesting letter on "Whist Decisions" appeared in these columns a few weeks ago, is due the theory that *B*'s play in the above game was suggested by malignity. The theory seems supported by strong evidence, especially as we are told that *B* deliberated for two minutes before playing to trick 8. He cannot have been deliberating about his play, for there could be no manner of doubt about that. Clearly a contest was going on between hatred on the one hand and the compunctious visitings of conscience on the other. Alas that his evil feelings should have prevailed at last!

Langenhoe Church and the Recent Earthquake (Extract from *Standard*, April 24, 1884).—"I had heard that Langenhoe Church was practically destroyed, but was hardly prepared for such a scene of wreckage as I found. It is, however, now little better than a ruin. The earthquake shook the old Norman tower to and fro, dislodging some tons of the stone battlements upon the roof, one half of which it carried away in its downward course, smashing the small gallery below, and filling half the nave breast-high with a confused heap of timbers and stone-work. At the same time the outer walls cracked in various directions, and the roof over the chancel fell in upon the communion-rail and pews below. The east window has become displaced, all the walls, even of the brick porch, a comparatively new part of the structure, are bulged and warped, and the tower, in which several fissures are observable, is considerably out of the perpendicular." We have received from Mr. Browning a very interesting photograph of the church, showing its condition since the earthquake. It is well worth studying.

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